

# The Reformed Byzantine Silver-Based Currencies (ca. 1372–1379) in Light of the Hoards from the Belgrade Gate

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## Introduction

The fourteenth century saw momentous changes to the Byzantine monetary system, perhaps more so than any other century of the empire's existence.<sup>1</sup> During its first half, the Byzantine gold currency, the hyperpyron, a creation of the Alexian coinage reform of ca. 1092, was still being issued. In 1304 the empire launched a new silver coin, the basilikon, based on the Venetian grosso, the foremost silver coin of the Aegean region.<sup>2</sup> Both of these issues were produced in large quantities at Constantinople especially in the first to third decades of the century, but were then gradually discontinued. The 1340s to 1360s are particularly obscure with regard to the coinages produced by the empire, although, as we shall see, the material and textual evidence suggests a significant shift in Constantinople and surrounding territories toward non-Byzantine coins. This article focuses on the new denominations, which were first minted in the name of Emperor John V Palaiologos (reigning, with co-emperors and interruptions, 1341–1391) and emerged in the 1360s or 1370s, according to the recent chronologies, to break radically

with the Byzantine monetary past. These new denominations comprised a heavy silver piece and its fractions, in parallel to which the Constantinople mint issued also a lesser denomination, lighter and baser, which shared certain typological traits with the fine silver coins.

## *The Hoards from the Belgrade Gate*

In December 1986, during restoration work at the Belgrade Gate of the Theodosian walls of Istanbul, at a depth of 1.5 meters on the inside of the city gate, a hoard of 1,221 base coins was discovered.<sup>3</sup> This hoard (henceforth: Belgratkapı 1), which had originally been wrapped in cloth, contained 1,218 coins of the same overall type and denomination, referred to here for reasons which will be explained as tornesi of John V. The remaining three coins were rare copper issues of the Byzantine mint of Thessalonike and from Genoese Chios, which have no further bearing on this study. In the following year, a couple of meters from the previous hoard, in a ceramic bowl inside the city walls, a hoard of 2,280 diverse silver and billon coins and other items

1 The standard reference for coins of the Palaiologan period is DOC 5.

2 I. Touratsoglou and J. Baker, "Byzantium of the Venetians, Greece of the 'Grossi'," in Bisanzio, *Venezia e il mondo franco-greco (XIII–XV secolo)*, ed. C. A. Maltezou and P. Schreiner (Venice, 2002), 203–33.

3 T. Gökyıldırım, "Belgratkapı defnesi – 1986," *Bülten (Türk Numismatik Derneği Yayınları)* 29–30 (1991): 39–47. This hoard has been further mentioned in *DOC* 5:16–17, 203, 212; C. Morrisson and S. Bendall, "Monnaies de la fin de l'empire byzantin à Dumbarton Oaks: Un catalogue de référence," *RN* 157 (2001): 471–93, at 491; J. Baker, "Later Medieval Monetary Life in Constantinople," *Anatolian Archaeology* 9 (2003): 35–36; idem, "A Coinage for Late Byzantine Morea under Manuel II Palaiologos (1391–1423)," *RN* 162 (2006): 395–416, at 404.

Table 1 Summary content of Belgratkapı 2.

Belgratkapı 2 Nos.	Issuing Authority	Denomination	No. of Coins
1–44	Byzantium: John V Palaiologos (1341–1391)	stavraton	44
45–1244	Byzantium: John V Palaiologos (1341–1391)	aspron	1200
1245–1257	Byzantium: Andronikos IV Palaiologos (1376–1379)	stavraton	13
1258–1588	Bulgaria: Ivan Aleksandăr with Mihail Asen (1331–1355 and posthumous)	grosso	331
1589–1697; 1762; 1900–1907	Venice: Jacopo Tiepolo (1229–1249) to Bartolomeo Gradenigo (1339–1342)	grosso	118
1698–1761; 1763–1899	Venice: Francesco Dandolo (1329–1339) to Andrea Contarini (1368–1382)	soldino	201
1908; 1910	Provence: Robert d’Anjou (1309–1343)	gigliato	2
1909; 1911	Anatolian beyliks: in the name of Robert d’Anjou (1309–1343)	gigliato	2
1912–2129	Latin Greece: Achaia, Athens, Naupaktos (ca. 1267–ca. 1347)	denier tournois	218
2130–2140	Rhodes: Dieudonné de Gozon (1346–1353) to Raymond Berenger (1365–1374)	gigliato	11
2141–2142	Chios: Maona Company	gigliato	2
2143–2146	Lesbos: Francesco Gattilusio (1355–1376)	soldino and denier	4
Islamic cabinet 1211/1	Jalayirids: Awais (1356–1374/75)	akçe	1
Islamic cabinet 1211/2–134	Osmanlis: Murad I (1360–1389)	akçe	133

of silver was discovered (Belgratkapı 2).<sup>4</sup> The former included, among other coins, what shall be termed here: 44 silver stavrata of John V; 1200 silver aspra of the same emperor; and 13 stavrata of his son Emperor Andronikos IV (sole reign 1376–1379) (see plate 1, nos. 1–4 for all the cited Byzantine issues). For convenience the coins of Belgratkapı 2 have been summarized in table 1. A few non-Byzantine specimens from this hoard have been illustrated on plate 1, nos. 5–13. In combination, these two hoards hold vastly more

specimens of these respective Byzantine denominations, especially tornesi and aspra, than all previously known specimens. While these hoards, now preserved at the Archaeological Museum in Istanbul (inventory numbers KD1355 and KD1376), will be examined in their totalities by Baker and Gökyıldırım in a future monograph, they provide us here with the ideal conditions for a reexamination of Byzantine monetary production which followed from the reform of John V.

### *The Historical Context for the Reformed Coinage of John V and Andronikos IV Palaiologoi*

In 1354 John V Palaiologos became sole emperor with the abdication of his erstwhile co-emperor John VI Kantakouzenos.<sup>5</sup> The second phase of the Second

4 Gökyıldırım, “Belgratkapı definesi – 1986,” 39; T. Gökyıldırım, “Belgratkapı definesi – 1987,” *Bülten (Türk Nüsmatik Derneği Yayınları)* 31 (1992): 8–20. See further *DOC* 5:16–17; A. M. Stahl, *Zecca: The Mint of Venice in the Middle Ages* (Baltimore, 2000), 453, no. 96; *Istanbul Archaeological Museums, Medical Exhibition from Past to Present* (Istanbul, 2002), 16–17; Baker, “Monetary Life”; B. Pitarakis, “Objects of Devotion and Protection,” in *A People’s History of Christianity*, vol. 3, *Byzantine Christianity*, ed. D. Krueger (Minneapolis, 2006), 164–81, at 178–79, 235, n. 30, pl. I; E. Lianta, “Some ‘Stavraton’ Hoards Re-examined,” *NCirc* 116, no. 3 (2008): 121–24.

5 On what follows, see principally C. Imber, *The Ottoman Empire 1300–1481* (Istanbul, 1990), 25–33; V. Nerantze-Vermaze, *To Βυζάντιο και η Δύση (1354–1369)* (Thessalonike, 1993); D. Nicol, *The Last Centuries of Byzantium*, 2nd edition (Cambridge, 1993), 256–82; N. Necipoğlu, *Byzantium between the Ottomans and the Latins: Politics*

Byzantine Civil War (traditionally: 1352–1357) was gradually coming to a close, but one of the major legacies of this conflict, the presence of the Osmanlis on European soil, was proving to be an increasingly serious threat to the empire. Freed from the obligations which they felt toward the Kantakouzenos family, Orhan and his son Murad conquered substantial tracts of imperial territories from the late 1350s onward, first along the northern shores of the Sea of Marmara, and then through a major campaign along the Maritsa (Meriç/Evros) River, the precise chronology of which remains difficult to reconstruct: Didymoteichon probably fell early on (1361) and Adrianople (Edirne) substantially later, after 1366 or more probably in 1369, after which it became the Ottoman capital.<sup>6</sup> Ottoman successes weighed heavily also on the Second Bulgarian Empire. Theoretically the Bulgarians were allies of Byzantium through a treaty of 1355, which had provided for the transfer to Byzantium of the important cities of Anchialos (Pomorie) and Mesembria (Nesebăr), on the Black Sea coast, as part of a dowry. As it turned out, this had to be enforced militarily by John V in the summer of 1364, though the success of this endeavor was short-lived.<sup>7</sup> John V faced therefore significant geostrategic difficulties during the initial period of his sole reign, and the solutions he proposed built around Latin/Catholic alliances. His Genoese brother-in-law Francesco Gattilusio was given control over the island of Lesbos in 1355. In the same year John sought material help from the papacy, to no avail. His hopes were further raised by discussions of a renewed crusade in the early 1360s, the main result of which proved to be the failed raid on Alexandria in 1365. More relevant to Byzantium, King Louis the Great of Hungary

began a holy war on Bulgaria in the same year. A year later, Amadeo VI of Savoy (the Green Count) set out to come to the aid of his cousin John V, in a crusading expedition which was initially aimed against the Ottomans, but which was redirected to the Bulgarian Black Sea coast when news reached Amadeo that John had in the meantime ventured to Hungary, but was then taken prisoner by the Bulgarians upon his attempted return to Constantinople.<sup>8</sup> The financial accounts of the expedition were meticulously recorded by Antonio Barbier.<sup>9</sup> In December 1366 John was able to join Amadeo, and he remained with him on campaign along the Bulgarian Black Sea coast until April 1367. Back in Constantinople, John paid Amadeo 15,000 florins. During this episode the question and utility of a union of the churches had once more come to the fore, and negotiations with Rome ensued. John finally set off for Italy in 1369, where he visited Naples, Rome, and Venice. His stay in the last of these cities was burdened by the continuous debt of the empire to the republic, accruing interest, and the status of the pawned imperial crown jewels, as well as the unresolved question of the handover of the northern Aegean island of Tenedos to Venice, designed to redress the balance between the two powers. According to the usual narrative, John's negotiations with the doge were hampered by his son Andronikos IV's refusal to collaborate, but he managed to leave Venice with a new substantial loan of 30,000 ducats, having been helped out of this impasse by his younger son Manuel.<sup>10</sup> The

and Society in the Late Empire (Cambridge, 2009), 119–28; R. Estangüi Gómez, *Byzance face aux Ottomans* (Paris, 2014), 124–34, 254–69.

6 See specifically E. Zachariadou, "The Conquest of Adrianople by the Turks," *Studi veneziani* 12 (1970): 211–17, and G. Vogiatzes, *Η Θράκη από το 14<sup>ο</sup> έως το 16<sup>ο</sup> αιώνα* (Xanthi, 1999). See also *TIB* 12: 161–62.

7 On these developments, see V. Gjuzev, "Der letzte Bulgarisch-Byzantinische Krieg (1364)," in *Geschichte und Kultur der Palaiologzeit, Referate des Internationalen Symposiums zu Ehren von Herbert Hunger* (Wien 30. Nov. bis 3. Dez. 1994), ed. W. Seibt (Vienna, 1996), 29–34; idem, "Mesembria durant le XIV<sup>e</sup> siècle: Histoire, population et monuments," in *Ο Μανουήλ Πανσέληνος και η εποχή του* (Athens, 1999), 147–57.

8 E. L. Cox, *The Green Count of Savoy: Amadeus VI and Transalpine Society in the Fourteenth Century* (Princeton, 1967), 204–39.

9 F. Bollatti di Saint-Pierre, ed., *Illustrazioni della spedizione in oriente di Amedeo VI (il Conte Verde)* (Turin, 1900). See also P. Soustal, "Historisch-topographisches aus dem Kontobuch des Antonio Barbier von 1366–1367," in *Byzantios: Festschrift für Herbert Hunger zum 70. Geburtstag*, ed. W. Hörandner et al. (Vienna, 1984), 311–20. The monetary importance of this document is treated in T. Bertelè, "Moneta veneziana e moneta bizantina," in *Venezia e il Levante fino al secolo XV*, vol. 1, *Storia–Diritto–Economia*, ed. A. Pertusi (Florence, 1973), 1:3–146, at 123–41; and M. Balard, "La circulation monétaire à Péra dans la seconde moitié du XIV<sup>e</sup> siècle," in *Χρήμα και αγορά στην εποχή των Παλαιολόγων*, ed. N. G. Moschonas (Athens, 2003), 365–71.

10 See however J. Chrysostomides, "John V Palaiologos in Venice (1370–1371) and the Chronicle of Caroldo: A Re-interpretation," *OCP* 31 (1965): 76–84. This alternative explanation concludes that the 1370 negotiations came to nothing because they were not in

emperor reached Constantinople again in October 1371. The period of John's Italian venture was detrimental to the empire strategically, politically, and morally: more substantial western aid was not a realistic prospect, and serious differences between John and his son Andronikos were coming to the fore. An appeasement with the Osmanlis, now firmly established in the heart of Thrace as we have seen, and recent victors against the Serbs on the Maritsa River, just to the west of Didymoteichon (September 1371), seemed inevitable. Again, the course of events is not entirely clear from the sources, although most plausibly John and Murad concluded a formal peace sometime between late 1371 and early 1373 (henceforth this interval will be referred to as ca. 1372). The two rulers began campaigning together in Anatolia, which triggered a plot against them in May 1373 by their respective sons, Andronikos IV and Savcı Çelebi. The revolt was curbed and Andronikos partially blinded and imprisoned, as a result of pressure put on John by Murad. In the spring and summer of 1376 the handover of Tenedos to Venice was in full preparation, which in turn may have caused the Genoese at Pera to engineer Andronikos's escape and sidelining of his father and brother Manuel II (August 1376). The Ottoman involvement in this regime change is unclear, although the outcome proved to be more beneficial to Murad than it did to the Genoese: the former regained previously lost territories around Gallipoli, while Andronikos supported Genoa in attempting to take the island of Tenedos, which was ultimately to no avail. In the summer of 1379, again apparently aided by Murad, John V managed to escape from his imprisonment in Constantinople and to reenter the city by way of Anatolia and Thrace, victoriously on 1 July.

We have seen that during the period ca. 1372–79 Emperors John V and Andronikos IV were variously involved with Murad. The disparate pieces of direct and circumstantial evidence do not allow one to describe these relationships in all their details.<sup>11</sup> What may be termed a vassalic and tributary relationship

was most probably established in ca. 1372 and then again from 1379, but there is also evidence in the form of a letter written by Demetrios Kydones in 1376/77 that payments were made from Byzantium to the sultanate during the sole reign of Andronikos. With regard to more precise figures, we are informed that yearly payments may have amounted to 30,000 gold coins from 1379.<sup>12</sup>

### *The Monetary Reform of John V: Recent Descriptions and Chronologies*

That John V reformed the Byzantine coinage system at one point during the period 1354–1376 is now agreed upon by scholars, and older ideas, for instance that the large silver coins of more than 8 grams were first minted during the sole reign of Andronikos IV after 1376, or even of John's father Andronikos III (†1341),<sup>13</sup> have now been discarded. Invariably all attempts to understand the nature and dating of this significant reform have focused on these heavy pieces, because of their unprecedented size and physical presence, their apparent recognizability in the documentary sources, and also because before the discovery of the hoards from the Belgrade Gate reliable archaeological data were very scarce. The discussion has centered on the identification of such coins in legal, financial, and narrative texts, and particularly on the identity of the various "crossed" coins (*stavrata*) and "silver" hyperpyra (*hyperpyra argyra*) which one finds therein.<sup>14</sup> The problems are common ones, those of identifying whether a particular term refers to a coin, and if so which one, or to a money of account. In fourteenth-century sources, *hyperpyron* is a vague term, denoting according to the existing historiography a Byzantine gold or silver coin, or different systems of account in Constantinople, Pera, Macedonia, and further afield (Mesembria, Chios, Crete, the Peloponnese, Negroponte, Slavonia, etc.), often based on non-Byzantine coins.

The two major contributors to the subject matter of the reform in the last couple of decades have been Philip

John's interest in terms of the remuneration, that there was no conflict with Andronikos at this point in time, and that the final 1376 handover of the island would merely have led to the return of the crown jewels, with no other form of payment, but that even this was not achieved because of John's ousting from the throne.

11 G. Ostrogorsky, "Byzance, état tributaire de l'empire turc," *ZRV* 5 (1985): 49–58.

12 See O. Iliescu, "Le montant du tribut payé par Byzance à l'empire ottoman en 1379 et 1424," *RESEE* 9 (1971): 427–32, although in his attempts to understand the nature of this payment he takes the specified term rather too literally (see also below).

13 P. Grierson, *Byzantine Coins* (London and Berkeley, 1982), 315.

14 C. Morrisson, "Les noms des monnaies sous les Paléologues," in Seibt, *Geschichte und Kultur*, 151–62, at 155–57.



Grierson and Andrey Ponomarev.<sup>15</sup> Grierson noted the absence of anything resembling stavrata in the account book of Barbier, which terminates in January 1367, but the presence of silver hyperpyra a few months later in a will (August 1367). The numismatist located therefore John's reform in this very short period between John's return to the imperial city in April 1367 and the summer of that year. Ponomarev, in an iconoclastic sweep, denied that the new heavy Byzantine coins were called stavrata, neither initially nor at any other point of their existence to the middle of the fifteenth century. The author deduced from hyperpyron–sommo exchange rates found in Genoese documents that Byzantium shifted from a gold-based to a silver-based hyperpyron sometime before 1374. He also remarked that if a stavraton of just 8.5 grams was introduced as early as 1367, it would have been remarkably overvalued (at half of a gold hyperpyron of account) given what we otherwise know about the gold–silver ratio applied to Latin and Balkan coins. This situation changed in the following years, with silver gaining gradually in relative value. The new Byzantine aspron, valued at  $\frac{1}{16}$  of a hyperpyron, was also shown by Ponomarev to contain almost exactly the same quantity of silver as the akçe of the Ottoman ruler Murad I. The author went on to consider the best timing for the debasement of the Byzantine currency and the adoption of an Ottoman-style coin, and suggested that ca. 1372 was the first possible moment and the most likely date for the reform.

One of the merits of Ponomarev's exposition is his skepticism toward relating apparent coin references in the sources directly to the availability/existence or not of the most obvious denomination in contemporary use. In the debate on John's reform there is in fact not a single case used in which the presence or absence of a particular term is entirely compelling. Much hangs especially on the silver hyperpyron, but it seems very probable, as we shall see, that the metropolitan Byzantine hyperpyron, even while still given

the epithet "gold" as is the case throughout Barbier's accounts, moved to a silver base in the central years of the fourteenth century. It is difficult to ascertain what precisely was meant by "silver" hyperpyra in the case of the 1367 will, but it appears to be most likely, whatever the date of John's reform, that these refer to hyperpyra based on Venetian grossi, for which there are parallel examples, especially in Macedonia, from where this term, as used by Grierson, originates.<sup>16</sup> Ultimately, Ponomarev commits the same error which he otherwise deplores by assuming too confidently, based on his interpretation of the usage of this term by Badoer and his associate "Critopulo della zecca," that stavrata consistently denoted silver gigliati of the Neapolitan, Provençal, and Rhodian tradition. The distinct possibility that the stavraton could refer to a range of coins during the span of its use is raised by the much-cited act of Chilandar (1348) mentioning *nomismata stavrata*:<sup>17</sup> given the date and the fact that this was a Serbian monastery, would it not be the most reasonable to assume that we are here witnessing hyperpyra *de cruce* of account, used within the Serbian state particularly under Stefan Uroš III Decanski (1321–1331), and his grandson Stefan Uroš IV Dušan (1331–1355), and based on Serbian grossi *de cruce*?<sup>18</sup> On the other hand, the stavraton coins referred to in the document published by Kugeas can in all likelihood be regarded as Byzantine silver issues since they originate in two Byzantine urban contexts (Thessalonike and Constantinople, 1419–38).<sup>19</sup>

In the concluding part of this paper we will return to Ponomarev's metrological and technical expositions, and add other considerations on coinages and systems of account. Even if some of his interpretations are doubtful, his overall approach of seeking a reasonable date for John's reform based on broad monetary and geopolitical considerations is surely correct. Information of this kind will be combined with some very precise data deriving from the in-depth study of

15 P. Grierson, "Le dernier siècle du monnayage byzantin: Problèmes et nouveautés," *Bulletin de la Classe des Lettres, Académie Royale de Belgique* 1–6 (1998): 99–123; *DOC* 5:200–220; A. L. Ponomarev, "Monetary Markets of Byzantium and the Golden Horde: State of Affairs According to the Account Books of the Genoese Treasurers of Caffa, 1374–1381," in *Mare and Litora: Essays Presented to S. Karpov on His 60th Birthday*, ed. R. Shukurov (Moscow, 2009), 595–611; idem, *Evoljucija deneznyh sistem Pričernomor'ja i Balkan v XIII–XIII vv.* (Moscow, 2011), 468–70, 529–38, 565–69, 587–90.

16 Compare *DOC* 5:201.

17 P. Grierson, "Les premiers stavrata: Pièces byzantines ou pièces provençales," *BSFN* (1995): 1060–63; Grierson, "Le dernier siècle," 115; *DOC* 5:29.

18 For this coinage, see V. Ivanišević, *Novčarstvo Srednjovekovne Srbije* (Belgrade, 2001), 207. See also below on this system of account.

19 S. Kugeas, "Notizbuch eines Beamten der Metropolis in Thessalonike aus dem Anfang des XV. Jahrhundert," *BZ* 23 (1914–19): 143–63.

the Belgratkapı 1 and 2 hoards to define the nature and date of the monetary reform of John V. With respect to the latter, it is clear from the preceding work that we will have to weigh the respective dates of 1367 and ca. 1372.

### *Premises of the Present Study*

This article rests on a number of premises and preliminary thoughts, some of which will be further substantiated. We will be using the terms *stavraton*, *aspron*, and *tornese* in the course of this article to designate the three main denominations of John's reform and the three main Byzantine denominations contained in the hoards. By doing so we do not claim that these were the original or only terms applied to the denominations of the reform by Greek speakers, nor that the same terms were not also applied to other coinages. However, these would have been terms used for these coins in the course of their existence, whereas other terms would clearly not have been used and are the wrong ones to be deployed by modern writers. Some of the names, as we shall see, used for the new thin and light piece emerging from the reform (the *tornese*) are a case in point. It is not the aim of this study to dwell on nomenclature. Next, we assume that Belgratkapı 1 and 2 were concealed by the same person or persons connected to one another, possibly related to the medical profession in the light of the non-coinage objects contained in Belgratkapı 2, and approximately in the same time frame. To suggest otherwise would suppose an unbelievable coincidence. The next premise of our study is that the hoards were concealed in 1379, with a numismatic margin of a year either side at the very most: the dating of the concealment of Belgratkapı 2 is suggested very strongly by the non-Byzantine coins contained therein, especially by the Venetian soldini (last issue type 3, 1369–1379: see below) and Rhodian gigliati whose internal typological developments clearly end around this time.<sup>20</sup> Also the Ottoman coins suggest the proposed dating, as we shall see. It is possible that there is a connection between the abandonment of the hoards in the walls of the Belgrade Gate and the political changes in the city and empire precipitated by John's return on 1 July 1379 through

what might have been the same gate (known as the Xylokerkos Gate), although again we will not dwell on this point.<sup>21</sup> In the further course of this article we will look into the profiles of the coins of John V, which confirm that none of these could have been issued during John's restoration after the summer of 1379. The third premise is that the main coinage of the Belgratkapı 1 is to be considered a *tornese* and not a *follaro*, as it is described in some of the cited literature. The difference between these terms is qualitative and conceptual, that is to say, the latter implies a copper coin of the late Roman and Byzantine tradition, often fiduciary and seldom minted according to a precisely applied intrinsic standard, the former a western-style billon coin, more precisely the *tournois*/*tornese* of French/Frankish Greek/Venetian tradition. This assumption rests on an assessment of the Lakonian issue in the name of Emperor Manuel II, son of John V, specifically its weight profile, which suggests that this was supposed to be a billon coinage minted on the standard of the Venetian *tornesello*.<sup>22</sup> The weights of the coins in Belgratkapı 1 confirm this entirely (see below). There cannot be much doubt that the main bust of emperor / cross patty (cross pattée), and Christ-in-mandorla / standing emperor types of the empire from the Constantinople and Lakonian mints all belonged to the same denomination. A recent hoard from the island of Lemnos (see appendix 1), in which the two types for Constantinople are combined, underlines this. The main varieties of the Christ-in-mandorla type in the names of Manuel II and John VII (*DOC* 5: nos. 1391–93 and 1603–9) were revealed to contain some silver in a run of older XRF analyses (3.6% and 6.0% respectively).<sup>23</sup> Kelly Domoney analyzed five *tornesi* in the collection of the Ashmolean Museum, University of Oxford, from the metropolitan mint for the reigns from John V to John VII, and perhaps later, and all produced silver readings between 2.3% and 6.8% (see appendix 2). It needs to be conceded that XRF readings for one or

20 See table 1 above. This information is for instance ignored for the chronological interpretations put forward by Lianta, "Some 'Stavraton' Hoards Re-examined" (n. 4 above).

21 N. Asutay-Effenberger, *Landmauer von Konstantinopel-Istanbul: Historisch-topographische und baugeschichtliche Untersuchungen* (Berlin and New York, 2007), 36.

22 Baker, "Manuel II Palaiologos" (n. 3 above).

23 N. Th. Georgiades, "Ανάλυση της χημικής σύστασης Βυζαντινών νομισμάτων (1204–1453) με τη μέθοδο XRF," *Byzantiaka* 25 (2005–6): 191–206, at 200 and 205, nos. 61–62.

two specimens of a particular coin type are not necessarily indicative of the overall standard of fineness that this issue was produced at. Considering that the trachy/assarion coinages of the previous generation of Byzantine minting contained virtually no silver at all,<sup>24</sup> one can still state without hesitation that the tornese of the two types was consciously minted as a billon coinage, with the possibility, subject to future verification, that the standard was slightly increased as the fourteenth century was coming to a close. Beside the fact that the alloy from which tornesi were manufactured was low-grade billon, it has been suggested that some or all of these coins were also silver washed or plated.<sup>25</sup> In order to establish this with greater confidence XRF analyses were conducted at Istanbul Archaeological Museum by Tuğçe Pamuk and Irmak Güneş Yüceil on some of the specimens from Belgratkapı 1 on which this phenomenon had first been observed (see appendix 3). The readings from two of the coins, which had evidently undergone some considerable cleaning, produced no silver. Two others suggest the usual low-grade silver alloy of around 3%, whereas one coin, Belgratkapı 1, no. 332 (plate 1, no. 14), produced higher readings of in excess of 20% silver, which seem to support Gökyıldırım's postulation. These five coins belong to the large and late grouping 3A (see below). Clearly, these findings must again be regarded as preliminary and the hoard has much potential for further archaeometric inquiries.

### Aspra, Tornesi, and Stavrata of John V and Andronikos IV Palaiologoi in the Light of the Belgrade Gate Hoards

#### *The Die Studies*

Aspra, tornesi, and stavrata contained in the two hoards from the Belgrade Gate formed the basis of an extensive die study: 462 aspra and 162 tornesi were selected from the respective totals of 1200 and 1218.<sup>26</sup>

24 *DOC* 5:47.

25 See Gökyıldırım, "Belgratkapı definesi – 1986" (n. 3 above), 39 and 44. The rejection of this idea by Morrisson and Bendall (note 3) was seemingly based solely on their belief that these coins must be copper follari.

26 The meticulous work on the dies of aspra and tornesi fell largely to Filippo Dompieri.

In making this selection, we had to be sure to cover all the significant types, as explained in the next discussion, while overcoming the limitations of bad legibility. The aspra of John V Palaiologos bear busts of Christ and the emperor on either side; his tornesi have a very similar emperor on one face and a cross patty on the other. To refer to sides, types, and dies, we will largely refrain from using the terms *obverse* and *reverse* in this paper, replacing them with *Christ* (or *cross patty*) and *emperor*. It was impossible to consider the side of the tornesi bearing the cross patty in the die study because the crosses all resembled one another too much. The emperor sides of the same coins, however, had to be compared to all the emperor sides of the same issuer's aspra, since it soon became clear that tornesi and aspra shared dies. Table 2, which contains the results of the die study, combines therefore the information for both denominations. Aspra and tornesi have been given continuous numbers (A001–A462; T001–T162), to which dies are matched (Christ dies C001–C181 and emperor dies E001–E104). The best specimen of each die has been illustrated (plates 2 and 3). Specimens from the same dies have been coded in the table for easier visibility, in shades of grey for the Christ sides and color for the emperor sides. More will be said below regarding the precise sequence of specimens and dies. Suffice it to say that it had to be consistent with the die linkages. Overall, the results of the die study were encouraging in the sense that an irrevertable internal logic emerged, and that we achieved good coverage. In an ideal world the results of the die study should give anybody with additional specimens a high chance of finding a die match within the material, especially for emperor dies. The only consideration which detracts from this is the bad state of preservation, especially of the tornesi. While we were always confident that a given specimen had a die match within the selected coins or remained a singleton, the resulting table and illustrations of all the dies (illustrated specimens marked with \* in the table) constitute somewhat less than a die corpus in the proper sense since some of the dies remain incompletely readable.

All 57 stavrata of the hoard (44 of John V [Js01–Js44] and 13 of Andronikos IV [As01–As13]) could be considered for a separate die study, the results of which are presented in a similar way in table 7 and plates 4 and 5, discussed below. Overall, the die study for the stavrata complements many of the results of table 2.

Table 2. Aspra in Belgratkapı 2 and tornesi in Belgratkapı 1 in order of established typologies and recording dies.

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A001	49	n/a	n/a	II	/	C001*	/	/	A	E001*	single	/	a
A002	50	n/a	n/a	II	/	C002*	/	/	A	E002*	single	/	a
A003	51	n/a	n/a	II	/	C003*	/	/	A	E003*	single	/	a
A004	52	n/a	n/a	II	/	C004*	/	/	A	E004*	single	/	a
T033	677	0.58	tight							E005*	single	/	3D+3E
T009	675	0.58	tight							E006*	single	/	3D+3E
T010	691	0.58	tight								single	/	3D+3E
T011	696	0.58	tight								single	/	3D+3E
T012	697	0.58	tight								single	/	3D+3E
T013	700	0.58	tight								single	/	3D+3E
T006	529	0.58	tight								single	/	3D+3E
T007	601	0.58	tight								single	/	3D+3E
T008	607	0.58	tight								single	/	3D+3E
T001	527	0.58	tight							E007	single	/	3D+3E
T002	528	0.58	tight								single	/	3D+3E
T003	536	0.58	tight							*	single	/	3D+3E
T004	620	0.58	tight								single	/	3D+3E
T005	635	0.58	tight								single	/	3D+3E
T014	531	0.58	tight							E008*	single	/	3D+3E
T015	532	0.58	tight							E009*	single	/	3D+3E
T016	533	0.58	tight							E010	single	/	3D+3E
T017	592	0.58	tight								single	/	3D+3E
T018	609	0.58	tight							*	single	/	3D+3E
T019	553	0.58	tight							E011*	single	/	3D+3E
T020	554	0.58	tight							E012*	single	/	3D+3E
T021	562	0.58	tight							E013	single	/	3D+3E
T022	650	0.58	tight								single	/	3D+3E
T023	604	0.58	tight							E014*	single	/	3D+3E
T024	608	0.58	tight							E015*	single	/	3D+3E
T025	611	0.58	tight							E016*	single	/	3D+3E
T026	612	0.58	tight							E017*	single	/	3D+3E
T027	613	0.58	tight							E018	single	/	3D+3E
T028	626	0.58	tight								single	/	3D+3E
T029	641	0.58	tight							E019*	single	/	3D+3E



Coin Data				Aspra						Aspra and Tornesi				
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side				
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type	
To30	647	0.58	tight							Eo20*	single	/	3D+3E	
To31	649	0.58	tight								single	/	3D+3E	
To32	652	0.58	tight							Eo21*	single	/	3D+3E	
Ao05	676	1.04	tight	IX	/	Co05	OCO11b	/	E	*	Eo22	tripart.	/	b
Ao06	747	1.04	tight	IX	/	*	OCO11b	/	E		tripart.	/	b	
Ao07	683	1.04	tight	IX	/	Co06*	OCO11b	/	E		tripart.	/	b	
Ao08	684	1.04	tight	IX	/		OCO11b	/	E		tripart.	/	b	
Ao09	714	1.04	tight	IX	/	Co07	OCO11b	/	E		tripart.	/	b	
Ao10	739	1.04	tight	IX	/		OCO11b	/	E		tripart.	/	b	
Ao11	757	1.04	tight	IX	/	*	OCO11b	/	E		tripart.	/	b	
Ao12	718	1.04	tight	IX	/	Co08*	OCO11b	/	E		tripart.	/	b	
Ao13	721	1.04	tight	IX	/	Co09	OCO11b	/	E		tripart.	/	b	
Ao14	736	1.04	tight	IX	/	*	OCO11b	/	E		tripart.	/	b	
Ao15	723	1.04	tight	IX	/	Co10*	OCO11b	/	E		tripart.	/	b	
Ao16	733	1.04	tight	IX	/	Co11*	OCO11b	/	E		tripart.	/	b	
Ao17	691	1.04	tight	IX	/	Co12*	OCO11b	/	E	Eo23	tripart.	/	b	
Ao18	713	1.04	tight	IX	/	Co13*	OCO11b	/	E	*	tripart.	/	b	
Ao19	728	1.04	tight	IX	/	Co14	OCO11b	/	E	Eo24*	tripart.	/	b	
Ao20	729	1.04	tight	IX	/	*	OCO11b	/	E		tripart.	/	b	
Ao21	717	1.04	tight	IX	/	Co15*	OCO11b	/	E	Eo25	tripart.	/	b	
Ao22	734	1.04	tight	IX	/	Co16*	OCO11b	/	E		tripart.	/	b	
Ao23	754	1.04	tight	IX	/	Co17*	OCO11b	/	E		tripart.	/	b	
Ao24	710	1.04	tight	IX	/	Co18...	OCO11b	/	E		tripart.	/	b	
Ao25	693	1.04	tight	IX	/	Co19	OCO11b	/	E	*	tripart.	/	b	
Ao26	720	1.04	tight	IX	/		OCO11b	/	E		tripart.	/	b	
Ao27	731	1.04	tight	IX	/		OCO11b	/	E		tripart.	/	b	
Ao28	763	1.04	tight	IX	/		*	OCO11b	/		E	tripart.	/	b
Ao29	716	1.04	tight	IX	/		OCO11b	/	E	Eo26	tripart.	/	b	
Ao30	719	1.04	tight	IX	/		OCO11b	/	E		tripart.	/	b	
Ao31	686	1.04	tight	IX	/	... Co18	OCO11b	/	E		tripart.		b	
Ao32	680	1.04	tight	IX	/	Co20	OCO11b	/	E		tripart.	/	b	
Ao33	681	1.04	tight	IX	/		OCO11b	/	E		tripart.	/	b	
Ao34	689	1.04	tight	IX	/		OCO11b	/	E		tripart.	/	b	
Ao35	741	1.04	tight	IX	/	*	OCO11b	/	E		tripart.	/	b	

Table 2. (*continued*)

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A036	752	1.04	tight	IX	/		OCOLIB	/	E	*	tripart.	/	b
A037	690	1.04	tight	IX	/	Co21*	OCOLIB	/	E		tripart.	/	b
A038	694	1.04	tight	IX	/	Co22*	OCOLIB	/	E		tripart.	/	b
A039	746	1.04	tight	IX	/		OCOLIB	/	E		tripart.	/	b
A040	724	1.04	tight	IX	/	Co23*	OCOLIB	/	E		tripart.	/	b
A041	761	1.04	tight	IX	/	Co24*	OCOLIB	/	E		tripart.	/	b
A042	781	1.04	tight	IX	/	Co25*	OCOLIB	/	E		tripart.	/	b
A043	45	n/a	n/a	I	/	Co26*	/	/	A		tripart.		b
A044	46	n/a	n/a	I	/		/	/	A		tripart.		b
A045	78	n/a	n/a	III	VIII	Co27*	/	* *	B		tripart.	/	b
A046	787	1.03	tight	X	I	Co28	dILOCO	/	F		tripart.	/	b
A047	852	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b
A048	862	1.03	tight	X	I	*	dILOCO	/	F		tripart.	/	b
A049	879	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b
A050	881	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b
A051	886	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b
A052	889	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b
A053	795	1.03	tight	X	I	Co29*	dILOCO	/	F		tripart.	/	b
A054	814	1.03	tight	X	I	Co30*	dILOCO	/	F		tripart.	/	b
A055	822	1.03	tight	X	I	Co31	dILOCO	/	F		tripart.	/	b
A056	863	1.03	tight	X	I	*	dILOCO	/	F		tripart.	/	b
A057	882	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b
A058	860	1.03	tight	X	I	Co32*	dILOCO	/	F		tripart.	/	b
A059	872	1.03	tight	X	I	Co33*	dILOCO	/	F		tripart.	/	b
A060	907	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b
A061	890	1.03	tight	X	I	Co34*	dILOCO	/	F		tripart.	/	b
A062	891	1.03	tight	X	I	Co35*	dILOCO	/	F		tripart.	/	b
A063	829	1.03	tight	X	I	Co36*	dILOCO	/	F		tripart.	/	b
A064	842	1.03	tight	X	I		dILOCO	/	F	E027	tripart.	/	b
A065	832	1.03	tight	X	I	Co37	dILOCO	/	F		tripart.	/	b
A066	902	1.03	tight	X	I	*	dILOCO	/	F		tripart.	/	b
A067	851	1.03	tight	X	I	Co38	dILOCO	/	F		tripart.	/	b
A068	866	1.03	tight	X	I	*	dILOCO	/	F		tripart.	/	b
A069	854	1.03	tight	X	I	Co39*	dILOCO	/	F		tripart.	/	b
A070	855	1.03	tight	X	I	Co40*	dILOCO	/	F		tripart.	/	b
A071	858	1.03	tight	X	I		dILOCO	/	F		tripart.	/	b

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A072	876	1.03	tight	X	I		dlloco	/	F	*	tripart.	/	b
A073	888	1.03	tight	X	I		dlloco	/	F		tripart.	/	b
A074	898	1.03	tight	X	I		dlloco	/	F		tripart.	/	b
A075	864	1.03	tight	X	I	Co41	dlloco	/	F		tripart.	/	b
A076	884	1.03	tight	X	I	*	dlloco	/	F		tripart.	/	b
A077	868	1.03	tight	X	I	Co42*	dlloco	/	F	E028*	tripart.	/	b
A078	892	1.03	tight	X	I	Co43*	dlloco	/	F	E029*	tripart.	/	b
A079	823	1.03	tight	X	I	Co44*	dlloco	/	F	E030	tripart.	/	b
A080	883	1.03	tight	X	I	Co45*	dlloco	/	F		tripart.	/	b
A081	895	1.03	tight	X	I	Co46	dlloco	/	F	*	tripart.	/	b
A082	913	1.03	tight	X	I	*	dlloco	/	F		tripart.	/	b
A083	911	1.03	tight	X	I	Co47*	dlloco	/	F		tripart.	/	b
A084	1048	n/a	n/a	XII	III	Co48*	dlloco	• •	H	E031	tripart.	/	b
A085	762	1.04	tight	IX	/	Co49*	OCOllb	/	E		tripart.	/	b
A086	952	1.06	tight	XI	II	Co50*	OCOTIP	• •	G		tripart.	/	b
A087	966	1.06	tight	XI	II	Co51	OCOTIP	• •	G	*	tripart.	/	b
A088	1000	1.06	tight	XI	II	*	OCOTIP	• •	G		tripart.	/	b
A089	931	1.06	tight	XI	II	Co52	OCOTIP	• •	G		tripart.	/	b
A090	956	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A091	965	1.06	tight	XI	II	*	OCOTIP	• •	G		tripart.	/	b
A092	919	1.06	tight	XI	II		OCOTIP	• •	G	E032	tripart.	/	b
A093	927	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A094	937	1.06	tight	XI	II		OCOTIP	• •	G	*	tripart.	/	b
A095	939	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A096	953	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A097	1002	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A098	1006	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A099	1040	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A100	932	1.06	tight	XI	II		OCOTIP	• •	G	E033	tripart.	/	b
A101	960	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A102	979	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A103	982	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A104	998	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A105	1013	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A106	961	1.06	tight	XI	II	Co53*	OCOTIP	• •	G		tripart.	/	b
A107	1025	1.06	tight	XI	II	Co54*	OCOTIP	• •	G		tripart.	/	b

Table 2. (continued)

Coin Data				Aspra						Aspra and Tornesi				
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side				
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type	
A108	430	1.03	broad	VI	/	Co55	/	• •	C	*	tripart.	/	b	
A109	459	1.03	broad	VI	/		/	• •	C		tripart.	/	b	
A110	453	1.03	broad	VI	/		/	• •	C		Eo34	tripart.	/	b
A111	467	1.03	broad	VI	/	*	/	• •	C	*	tripart.	/	b	
A112	436	1.03	broad	VI	/	Co56*	/	• •	C		tripart.	/	b	
A113	445	1.03	broad	VI	/		/	• •	C		tripart.	/	b	
A114	958	1.06	tight	XI	II	Co57*	OCOTIP	• •	G	Eo35	tripart.	/	b	
A115	920	1.06	tight	XI	II	Co58	OCOTIP	• •	G		tripart.	/	b	
A116	930	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b	
A117	933	1.06	tight	XI	II		OCOTIP	• •	G	tripart.	/	b		
A118	949	1.06	tight	XI	II		OCOTIP	• •	G	tripart.	/	b		
A119	954	1.06	tight	XI	II		OCOTIP	• •	G	tripart.	/	b		
A120	986	1.06	tight	XI	II		OCOTIP	• •	G	tripart.	/	b		
A121	994	1.06	tight	XI	II		OCOTIP	• •	G	tripart.	/	b		
A122	996	1.06	tight	XI	II		*	OCOTIP	• •	G	tripart.	/	b	
A123	997	1.06	tight	XI	II			OCOTIP	• •	G	*	tripart.	/	b
A124	1001	1.06	tight	XI	II			OCOTIP	• •	G		tripart.	/	b
A125	1029	1.06	tight	XI	II	OCOTIP		• •	G	tripart.		/	b	
A126	1035	1.06	tight	XI	II	OCOTIP	• •	G	tripart.	/		b		
A127	940	1.06	tight	XI	II	Co59*	OCOTIP	• •	G	tripart.		/	b	
A128	971	1.06	tight	XI	II	Co60	OCOTIP	• •	G	tripart.		/	b	
A129	980	1.06	tight	XI	II	*	OCOTIP	• •	G	tripart.	/	b		
A130	1031	1.06	tight	XI	II		OCOTIP	• •	G	tripart.	/	b		
A131	1022	1.06	tight	XI	II	Co61*	OCOTIP	• •	G	tripart.	/	b		
A132	1026	1.06	tight	XI	II	Co62*	OCOTIP	• •	G	tripart.	/	b		
A133	921	1.06	tight	XI	II	Co63*	OCOTIP	• •	G	Eo36*	tripart.	/	b	
A134	926	1.06	tight	XI	II	Co64	OCOTIP	• •	G	Eo37	tripart.	/	b	
A135	1016	1.06	tight	XI	II	*	OCOTIP	• •	G		tripart.	/	b	
A136	935	1.06	tight	XI	II	Co65...*	OCOTIP	• •	G		tripart.	/	b	
A137	963	1.06	tight	XI	II	Co66*	OCOTIP	• •	G	tripart.	/	b		
A138	1037	1.06	tight	XI	II	Co67*	OCOTIP	• •	G	tripart.	/	b		
A139	1004	1.06	tight	XI	II	Co68*	OCOTIP	• •	G	Eo38*	tripart.	/	b	
A140	1021	1.06	tight	XI	II	Co69*	OCOTIP	• •	G	Eo39*	tripart.	/	b	
A141	957	1.06	tight	XI	II	...Co65	OCOTIP	• •	G	Eo40	tripart.	/	b	
A142	432	1.03	broad	VI	/	Co70	/	• •	C	*	tripart.	/	b	
A143	439	1.03	broad	VI	/	*	/	• •	C		tripart.	/	b	



Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A144	470	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A145	730	1.04	tight	IX	/	Co71*	OCOLIB	/	E		tripart.	/	b
A146	1116	1.04	tight	XIII	IV	Co72*	OCOTIP	• •	G	Eo41	tripart.	• •	d
A147	1101	1.04	tight	XIII	IV	Co73*	OCOTIP	• •	G		tripart.	• •	d
A148	1089	1.04	tight	XIII	IV	Co74*	OCOTIP	• •	G		tripart.	• •	d
A149	1148	1.04	tight	XIII	IV	Co75	OCOTIP	• •	G		tripart.	• •	d
A150	1140	1.04	tight	XIII	IV	*	OCOTIP	• •	G		tripart.	• •	d
A151	1080	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
To34	461	0.58	medium							*	tripart.	• •	3B
To35	436	0.58	medium								tripart.	• •	3B
To36	425	0.58	medium								tripart.	• •	3B
To37	408	0.58	medium								tripart.	• •	3B
A152	1190	1.04	tight	XIII	IV	Co76	OCOTIP	• •	G	*	tripart.	• •	d
A153	1176	1.04	tight	XIII	IV	*	OCOTIP	• •	G		tripart.	• •	d
A154	1152	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A155	1147	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A156	1137	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A157	1136	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A158	1135	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A159	1131	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A160	1129	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A161	1126	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A162	1117	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A163	1113	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A164	1104	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A165	1091	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A166	1081	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A167	1078	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A168	1075	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A169	1065	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A170	1061	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A171	1097	1.04	tight	XIII	IV		OCOTIP	• •	G	Eo42*	tripart.	• •	d
A172	1070	1.04	tight	XIII	IV	Co77*	OCOTIP	• •	G		tripart.	• •	d
A173	1057	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A174	1050	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A175	1107	1.04	tight	XIII	IV	Co78...	OCOTIP	• •	G	Eo43*	tripart.	• •	d

Table 2. (continued)

Coin Data				Aspra						Aspra and Tornesi					
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side					
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type		
A176	1110	1.04	tight	XIII	IV	*	OCOTIP	• •	G	Eo44*	tripart.	• •	d		
A177	1205	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d		
A178	1100	1.04	tight	XIII	IV		OCOTIP	• •	G		Eo45	tripart.	• •	d	
A179	1125	1.04	tight	XIII	IV		OCOTIP	• •	G			tripart.	• •	d	
A180	1064	1.04	tight	XIII	IV	Co79	OCOTIP	• •	G	*	tripart.	• •	d		
A181	1146	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d		
A182	1212	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d		
To38	488	0.58	medium								tripart.	• •	3B		
To39	411	0.58	medium							tripart.	• •	3B			
To40	420	0.58	medium							*	tripart.	• •	3B		
To41	458	0.58	medium								tripart.	• •	3B		
To42	463	0.58	medium								tripart.	• •	3B		
To43	467	0.58	medium								tripart.	• •	3B		
A183	1071	1.04	tight								XIII	IV	Co80*	OCOTIP	• •
To44	489	0.58	medium							*	tripart.	• •	3B		
To45	491	0.58	medium								tripart.	• •	3B		
To46	422	0.58	medium								tripart.	• •	3B		
A184	1083	1.04	tight								XIII	IV	Co81	OCOTIP	• •
A185	1090	1.04	tight	XIII	IV	OCOTIP	• •	G	tripart.	• •	d				
A186	1142	1.04	tight	XIII	IV	*	OCOTIP	• •	G	*	tripart.	• •		d	
A187	1160	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •		d	
A188	1175	1.04	tight	XIII	IV	Co82	OCOTIP	• •	G	Eo48	tripart.	• •	d		
A189	1084	1.04	tight	XIII	IV		OCOTIP	• •	G		*	tripart.	• •	d	
A190	1179	1.04	tight	XIII	IV		*	OCOTIP	• •			G	tripart.	• •	d
A191	1115	1.04	tight	XIII	IV		Co83*	OCOTIP	• •		G	Eo49*	tripart.	• •	d
A192	1163	1.04	tight	XIII	IV	Co84*	OCOTIP	• •	G	Eo50*	tripart.	• •	d		
To47	413	0.58	medium								tripart.	• •	3B		
To48	426	0.58	medium								tripart.	• •	3B		
To49	447	0.58	medium								*	tripart.	• •	3B	
To50	404	0.58	medium							tripart.		• •	3B		
To51	401	0.58	medium							Eo51		tripart.	• •	3B	
To52	402	0.58	medium								*	tripart.	• •	3B	
To53	407	0.58	medium									tripart.	• •	3B	
To54	410	0.58	medium	tripart.	• •	3B									
To55	417	0.58	medium	tripart.	• •	3B									
To56	427	0.58	medium							tripart.	• •	3B			

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
To57	432	0.58	medium								tripart.	• •	3B
To58	434	0.58	medium								tripart.	• •	3B
To59	439	0.58	medium								tripart.	• •	3B
To60	441	0.58	medium								tripart.	• •	3B
To61	442	0.58	medium								tripart.	• •	3B
To62	443	0.58	medium								tripart.	• •	3B
To63	454	0.58	medium								tripart.	• •	3B
To64	459	0.58	medium								tripart.	• •	3B
To65	462	0.58	medium								tripart.	• •	3B
To66	464	0.58	medium								tripart.	• •	3B
To67	470	0.58	medium								tripart.	• •	3B
To68	472	0.58	medium								tripart.	• •	3B
To69	474	0.58	medium								tripart.	• •	3B
To70	477	0.58	medium								tripart.	• •	3B
To71	478	0.58	medium								tripart.	• •	3B
To72	481	0.58	medium								tripart.	• •	3B
To73	492	0.58	medium								tripart.	• •	3B
To74	403	0.58	medium							E052*	tripart.	• •	3B
To75	409	0.58	medium							E053*	tripart.	• •	3B
To76	412	0.58	medium							E054	tripart.	• •	3B
To77	424	0.58	medium								tripart.	• •	3B
To78	438	0.58	medium							*	tripart.	• •	3B
To79	484	0.58	medium								tripart.	• •	3B
To80	453	0.58	medium							E055*	tripart.	• •	3B
To81	457	0.58	medium							E056*	tripart.	• •	3B
To82	490	0.58	medium							E057*	tripart.	• •	3B
A193	1182	1.04	tight	XIII	IV	Co85*	OCOTIP	• •	G	E058	tripart.	• •	d
A194	1087	1.04	tight	XIII	IV	Co86*	OCOTIP	• •	G		tripart.	• •	d
A195	1168	1.04	tight	XIII	IV	Co87*	OCOTIP	• •	G		tripart.	• •	d
A196	1096	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A197	1076	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A198	1149	1.04	tight	XIII	IV	Co88*	OCOTIP	• •	G		tripart.	• •	d
A199	1073	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A200	1120	1.04	tight	XIII	IV	Co89*	OCOTIP	• •	G	*	tripart.	• •	d
A201	1072	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A202	1186	1.04	tight	XIII	IV	Co90	OCOTIP	• •	G		tripart.	• •	d

Table 2. (*continued*)

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A203	1185	1.04	tight	XIII	IV	*	OCOTIP	• •	G		tripart.	• •	d
A204	1128	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A205	1102	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A206	1082	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A207	1062	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A208	1049	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A209	1036	1.06	tight	XI	II	Co91	OCOTIP	• •	G	Eo59*	tripart.	/	b
A210	1181	1.04	tight	XIII	IV	*	OCOTIP	• •	G	Eo60	tripart.	• •	d
A211	1063	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A212	1055	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A213	541	1.03	broad	VII	V	Co92*	/	• •	C		tripart.	• •	d
A214	1145	1.04	tight	XIII	IV	Co93*	OCOTIP	• •	G	*	tripart.	• •	d
A215	1105	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A216	1059	1.04	tight	XIII	IV	... Co78	OCOTIP	• •	G		tripart.	• •	d
A217	1103	1.04	tight	XIII	IV		OCOTIP	• •	G	Eo61	tripart.	• •	d
A218	545	1.03	broad	VII	V	Co94*	/	• •	C	*	tripart.	• •	d
A219	973	1.06	tight	XI	II	Co95...	OCOTIP	• •	G	Eo62	tripart.	/	b
A220	1009	1.06	tight	XI	II		OCOTIP	• •	G	*	tripart.	/	b
A221	463	1.03	broad	VI	/	Co96	/	• •	C	Eo63	tripart.	/	b
A222	443	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A223	442	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A224	441	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A225	435	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A226	433	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A227	431	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A228	429	1.03	broad	VI	/		/	• •	C		tripart.	/	b
A229	1018	1.06	tight	XI	II	... Co95*	OCOTIP	• •	G	Eo64	tripart.	/	b
A230	955	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A231	941	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A232	929	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A233	991	1.06	tight	XI	II	Co97	OCOTIP	• •	G		tripart.	/	b
A234	988	1.06	tight	XI	II		OCOTIP	• •	G		tripart.	/	b
A235	1051	1.04	tight	XIII	IV	*	OCOTIP	• •	G		tripart.	• •	d
A236	1123	1.04	tight	XIII	IV	Co98*	OCOTIP	• •	G		tripart.	• •	d
A237	1114	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A238	1161	1.04	tight	XIII	IV	Co99	OCOTIP	• •	G		tripart.	• •	d



Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A239	1106	1.04	tight	XIII	IV	*	OCOTIP	• •	G	*	tripart.	• •	d
A240	1093	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A241	1199	1.04	tight	XIII	IV	C100	OCOTIP	• •	G		tripart.	• •	d
A242	1178	1.04	tight	XIII	IV	*	OCOTIP	• •	G		tripart.	• •	d
A243	1088	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A244	1085	1.04	tight	XIII	IV	C101*	OCOTIP	• •	G		tripart.	• •	d
A245	1066	1.04	tight	XIII	IV	C102*	OCOTIP	• •	G		tripart.	• •	d
A246	1141	1.04	tight	XIII	IV	C103*	OCOTIP	• •	G		tripart.	• •	d
A247	1053	1.04	tight	XIII	IV		OCOTIP	• •	G		tripart.	• •	d
A248	641	1.03	broad	VII	V	C104*	/	• •	C		tripart.	• •	d
A249	625	1.03	broad	VII	V	C105*	/	• •	C		tripart.	• •	d
A250	519	1.03	broad	VII	V	C106*	/	• •	C		tripart.	• •	d
A251	482	1.03	broad	VII	V	C107*	/	• •	C		tripart.	• •	d
A252	623	1.03	broad	VII	V	C108	/	• •	C		tripart.	• •	d
A253	480	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d
A254	1092	1.04	tight	XIII	IV	C109*	OCOTIP	• •	G	Eo65	tripart.	• •	d
A255	630	1.03	broad	VII	V	C110	/	• •	C		tripart.	• •	d
A256	591	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d
A257	582	1.03	broad	VII	V	C111*	/	• •	C		tripart.	• •	d
A258	571	1.03	broad	VII	V	C112*	/	• •	C		tripart.	• •	d
A259	627	1.03	broad	VII	V	C113	/	• •	C		tripart.	• •	d
A260	557	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d
A261	610	1.03	broad	VII	V	C114*	/	• •	C		tripart.	• •	d
A262	542	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A263	505	1.03	broad	VII	V	C115*	/	• •	C		tripart.	• •	d
A264	628	1.03	broad	VII	V	C116	/	• •	C		tripart.	• •	d
A265	611	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A266	600	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A267	502	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d
A268	578	1.03	broad	VII	V	C117*	/	• •	C		tripart.	• •	d
A269	492	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A270	580	1.03	broad	VII	V	C118	/	• •	C	*	tripart.	• •	d
A271	494	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A272	485	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A273	475	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d
A274	474	1.03	broad	VII	V		/	• •	C		tripart.	• •	d

Table 2. (*continued*)

Coin Data				Aspra						Aspra and Tornesi				
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side				
						die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type	
A275	629	1.03	broad	VII	V	C119	/	• •	C	Eo66	tripart.	• •	d	
A276	551	1.03	broad	VII	V		/	• •	C		tripart.	• •	d	
A277	532	1.03	broad	VII	V		/	• •	C		tripart.	• •	d	
A278	512	1.03	broad	VII	V		/	• •	C		tripart.	• •	d	
A279	507	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d	
A280	626	1.03	broad	VII	V	C120*	/	• •	C		tripart.	• •	d	
A281	592	1.03	broad	VII	V	C121*	/	• •	C		tripart.	• •	d	
A282	590	1.03	broad	VII	V	C122*	/	• •	C		tripart.	• •	d	
A283	488	1.03	broad	VII	V		/	• •	C		tripart.	• •	d	
A284	647	1.03	broad	VII	V		C123	/	• •		C	tripart.	• •	d
A285	631	1.03	broad	VII	V		/	• •	C		tripart.	• •	d	
A286	622	1.03	broad	VII	V	/	• •	C	tripart.	• •	d			
A287	608	1.03	broad	VII	V	/	• •	C	tripart.	• •	d			
A288	599	1.03	broad	VII	V	/	• •	C	tripart.	• •	d			
A289	543	1.03	broad	VII	V	/	• •	C	*	tripart.	• •	d		
A290	501	1.03	broad	VII	V	/	• •	C		tripart.	• •	d		
A291	477	1.03	broad	VII	V	/	• •	C		tripart.	• •	d		
A292	637	1.03	broad	VII	V	/	• •	C		Eo67	tripart.	• •	d	
A293	575	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A294	550	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A295	536	1.03	broad	VII	V	C124	/	• •	C		tripart.	• •	d	
A296	520	1.03	broad	VII	V	/	• •	C	*	tripart.	• •	d		
A297	514	1.03	broad	VII	V	/	• •	C		tripart.	• •	d		
A298	620	1.03	broad	VII	V	/	• •	C		Eo68	tripart.	• •	d	
A299	635	1.03	broad	VII	V	C125	/	• •			C	tripart.	• •	d
A300	624	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A301	587	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A302	579	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A303	555	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A304	546	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A305	544	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A306	540	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A307	525	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A308	513	1.03	broad	VII	V	/	• •	C	tripart.		• •	d		
A309	504	1.03	broad	VII	V	/	• •	C	tripart.	• •	d			
A310	481	1.03	broad	VII	V	/	• •	C	tripart.	• •	d			

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A311	479	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A312	476	1.03	broad	VII	V	*	/	• •	C	*	tripart.	• •	d
A313	556	1.03	broad	VII	V	C126	/	• •	C		tripart.	• •	d
A314	516	1.03	broad	VII	V		/	• •	C	E069*	tripart.	• •	d
A315	500	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A316	484	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d
A317	621	1.03	broad	VII	V	C127	/	• •	C		tripart.	• •	d
A318	553	1.03	broad	VII	V	*	/	• •	C		tripart.	• •	d
A319	438	1.03	broad	VII	V		/	• •	C	E070*	tripart.	/	b
A320	448	1.03	broad	VII	V		/	• •	C		tripart.	/	b
A327	456	1.03	broad	VI	/	C128*	/	• •	C		tripart.	/	b
A321	510	1.03	broad	VII	V	C129	/	• •	C	E071*	tripart.	• •	d
A322	634	1.03	broad	VII	V	*	/	• •	C	E072	tripart.	• •	d
A323	605	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A324	523	1.03	broad	VII	V		/	• •	C		tripart.	• •	d
A325	478	1.03	broad	VII	V		/	• •	C	*	tripart.	• •	d
A326	593	1.03	broad	VII	V	C130*	/	• •	C		tripart.	• •	d
A328	53	n/a	n/a	III	VIII	C131*	/	* *	B	E073	tripart.	/	b
A329	55	n/a	n/a	III	VIII		/	* *	B	*	tripart.	/	b
A330	70	n/a	n/a	III	VIII		/	* *	B		tripart.	/	b
A331	57	n/a	n/a	III	VIII		/	* *	B	E074	tripart.	/	b
A332	79	n/a	n/a	III	VIII		/	* *	B		tripart.	/	b
A333	59	n/a	n/a	III	VIII	C132*	/	* *	B		tripart.	/	b
A334	60	n/a	n/a	III	VIII	C133	/	* *	B		tripart.	/	b
A335	63	n/a	n/a	III	VIII	*	/	* *	B		tripart.	/	b
A336	67	n/a	n/a	III	VIII		/	* *	B		tripart.	/	b
A337	66	n/a	n/a	III	VIII	C134*	/	* *	B		tripart.	/	b
A338	73	n/a	n/a	III	VIII	C135*	/	* *	B		tripart.	/	b
A339	76	n/a	n/a	III	VIII	C136*	/	* *	B		tripart.	/	b
A340	54	n/a	n/a	III	VIII	C137	/	* *	B		tripart.	/	b
A341	56	n/a	n/a	III	VIII		/	* *	B		tripart.	/	b
A342	62	n/a	n/a	III	VIII		/	* *	B		tripart.	/	b
A343	65	n/a	n/a	III	VIII	*	/	* *	B		tripart.	/	b
A344	69	n/a	n/a	III	VIII		/	* *	B	*	tripart.	/	b
A345	72	n/a	n/a	III	VIII		/	* *	B		tripart.	/	b
A346	74	n/a	n/a	III	VIII		/	* *	B		tripart.	/	b

Table 2. (continued)

Coin Data				Aspra						Aspra and Tornesi						
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side						
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type			
A347	80	n/a	n/a	III	VIII		/	*	*	B	E075	tripart.	/	b		
A348	82	n/a	n/a	III	VIII		/	*	*	B		tripart.	/	b		
A349	262	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A350	220	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A351	85	1.03	broad	IV	X	C138...*	/	*	*	B	*	tripart.	*	*	c	
A352	401	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A353	340	1.03	broad	IV	X		C139	/	*	*		B	tripart.	*	*	c
A354	306	1.03	broad	IV	X		*	/	*	*		B	tripart.	*	*	c
A355	113	1.03	broad	IV	X	C140...	/	*	*	B	E076	tripart.	*	*	c	
A356	294	1.03	broad	IV	X	C141	/	*	*	B		tripart.	*	*	c	
A357	185	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A358	109	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A359	83	1.03	broad	IV	X	*	/	*	*	B	*	tripart.	*	*	c	
A360	350	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
To83	309	0.58	broad							*	tripart.	*	*	3A		
To84	265	0.58	broad								tripart.	*	*	3A		
To85	256	0.58	broad								tripart.	*	*	3A		
To86	184	0.58	broad								tripart.	*	*	3A		
To87	183	0.58	broad								tripart.	*	*	3A		
To88	161	0.58	broad								tripart.	*	*	3A		
To89	75	0.58	broad								tripart.	*	*	3A		
To90	65	0.58	broad								tripart.	*	*	3A		
A361	121	1.03	broad	IV	X	C142*	/	*	*	B	*	tripart.	*	*	c	
A362	343	1.03	broad	IV	X	C143*	/	*	*	B		tripart.	*	*	c	
A363	362	1.03	broad	IV	X	C144	/	*	*	B		tripart.	*	*	c	
A364	281	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A365	233	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A366	229	1.03	broad	IV	X		/	*	*	B	tripart.	*	*	c		
A367	135	1.03	broad	IV	X	*	/	*	*	B	E077*	tripart.	*	*	c	
A368	157	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A369	324	1.03	broad	IV	X		... C138	/	*	*		B	E078*	tripart.	*	*
A370	84	1.03	broad	IV	X	... C140*	/	*	*	B	E079*	tripart.	*	*	c	
A371	389	1.03	broad	IV	X	C145*	/	*	*	B	E080*	tripart.	*	*	c	
A372	168	1.03	broad	IV	X		/	*	*	B		tripart.	*	*	c	
A373	400	1.03	broad	IV	X		C146*	/	*	*	B	E081	tripart.	*	*	c
A374	404	1.03	broad	IV	X		C147	/	*	*	B		tripart.	*	*	c



Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
						die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A375	336	1.03	broad	IV	X	*	/	* *	B	*	tripart.	* *	c
A376	210	1.03	broad	IV	X	C148*	/	* *	B		tripart.	* *	c
A377	162	1.03	broad	IV	X	C149*	/	* *	B		tripart.	* *	c
A378	148	1.03	broad	IV	X	C150*	/	* *	B		tripart.	* *	c
A379	375	1.03	broad	IV	X	C151	/	* *	B		tripart.	* *	c
A380	126	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c
A381	395	1.03	broad	IV	X	C152	/	* *	B		tripart.	* *	c
A382	394	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A383	359	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A384	334	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A385	118	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c
To91	181	0.58	broad							tripart.	* *	3A	
To92	148	0.58	broad							tripart.	* *	3A	
To93	118	0.58	broad							tripart.	* *	3A	
To94	67	0.58	broad							tripart.	* *	3A	
To95	56	0.58	broad							tripart.	* *	3A	
To96	41	0.58	broad							tripart.	* *	3A	
To97	39	0.58	broad							tripart.	* *	3A	
To98	37	0.58	broad							tripart.	* *	3A	
To99	35	0.58	broad							tripart.	* *	3A	
T100	31	0.58	broad							tripart.	* *	3A	
T101	28	0.58	broad							tripart.	* *	3A	
T102	27	0.58	broad							tripart.	* *	3A	
T103	24	0.58	broad							tripart.	* *	3A	
T104	19	0.58	broad							tripart.	* *	3A	
T105	286	0.58	broad							tripart.	* *	3A	
T106	258	0.58	broad							tripart.	* *	3A	
A386	310	1.03	broad	IV	X	C153	/	* *	B	Eo82	tripart.	* *	c
A387	379	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A388	338	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A389	275	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A390	263	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c
A391	238	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A392	151	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A393	99	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A394	388	1.03	broad	IV	X	C154*	/	* *	B	*	tripart.	* *	c

Table 2. (continued)

Coin Data				Aspra						Aspra and Tornesi				
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side				
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type	
A395	382	1.03	broad	IV	X	C155*	/	* *	B		tripart.	* *	c	
A396	374	1.03	broad	IV	X	C156*	/	* *	B		tripart.	* *	c	
A397	370	1.03	broad	IV	X	C157*	/	* *	B		tripart.	* *	c	
A398	284	1.03	broad	IV	X	C158	/	* *	B		tripart.	* *	c	
A399	273	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c	
A400	396	1.03	broad	IV	X	C159	/	* *	B		tripart.	* *	c	
A401	181	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c	
A402	319	1.03	broad	IV	X	C160	/	* *	B		tripart.	* *	c	
A403	309	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A404	255	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A405	224	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A406	172	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A407	87	1.03	broad	IV	X		*	/	* *		B	tripart.	* *	c
T107	185	0.58	broad							*	tripart.	* *	3A	
T108	23	0.58	broad								tripart.	* *	3A	
A408	413	1.03	broad	IV	X	C161*	/	* *	B	Eo83*	tripart.	* *	c	
A409	381	1.03	broad	IV	X	C162*	/	* *	B	Eo84*	tripart.	* *	c	
A410	428	n/a	n/a	V	VI	C163	/	• •	C	Eo85	tripart.	* *	c	
A411	427	n/a	n/a	V	VI	*	/	• •	C		tripart.	* *	c	
A412	426	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A413	425	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A414	424	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A415	423	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A416	422	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A417	421	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A418	420	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A419	419	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A420	418	n/a	n/a	V	VI		/	• •	C		tripart.	* *	c	
A421	272	1.03	broad	IV	X	C164*	/	* *	B	*	tripart.	* *	c	
A422	397	1.03	broad	IV	X	C165	/	* *	B		tripart.	* *	c	
A423	352	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A424	286	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A425	236	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A426	180	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A427	167	1.03	broad	IV	X		/	* *	B		tripart.	* *	c	
A428	363	1.03	broad	IV	X		/	* *	B	Eo86	tripart.	* *	c	

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A429	212	1.03	broad	IV	X	*	/	* *	B	*	tripart.	* *	c
A430	292	1.03	broad	IV	X		/	* *	B	E087*	tripart.	* *	c
T109	43	0.58	broad							*	tripart.	* *	3A
T110	55	0.58	broad								tripart.	* *	3A
T111	311	0.58	broad							E088*	tripart.	* *	3A
T112	304	0.58	broad							E089*	tripart.	* *	3A
T113	302	0.58	broad								tripart.	* *	3A
T114	297	0.58	broad							E090	tripart.	* *	3A
T115	273	0.58	broad							*	tripart.	* *	3A
T116	261	0.58	broad							E091	tripart.	* *	3A
T117	97	0.58	broad							*	tripart.	* *	3A
T118	48	0.58	broad							E092*	tripart.	* *	3A
T119	40	0.58	broad							E093*	tripart.	* *	3A
T120	92	0.58	broad							E094	tripart.	* *	3A
T121	22	0.58	broad								tripart.	* *	3A
T122	63	0.58	broad								tripart.	* *	3A
T123	50	0.58	broad								tripart.	* *	3A
T124	14	0.58	broad								tripart.	* *	3A
T125	11	0.58	broad								tripart.	* *	3A
T126	5	0.58	broad								tripart.	* *	3A
T127	4	0.58	broad								tripart.	* *	3A
T128	328	0.58	broad								tripart.	* *	3A
T129	189	0.58	broad								tripart.	* *	3A
T130	146	0.58	broad								tripart.	* *	3A
T131	78	0.58	broad								tripart.	* *	3A
T132	69	0.58	broad								tripart.	* *	3A
T133	53	0.58	broad								tripart.	* *	3A
T134	49	0.58	broad								tripart.	* *	3A
T135	3	0.58	broad							*	tripart.	* *	3A
T136	47	0.58	broad							E095*	tripart.	* *	3A
T137	2	0.58	broad								tripart.	* *	3A
A431	392	1.03	broad	IV	X	C166	/	* *	B	E096	tripart.	* *	c
A432	299	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c
A433	261	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A434	323	1.03	broad	IV	X	C167*	/	* *	B		tripart.	* *	c
A435	259	1.03	broad	IV	X		/	* *	B		tripart.	* *	c

Table 2. (continued)

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
A436	191	1.03	broad	IV	X		/	* *	B	*	tripart.	* *	c
A437	176	1.03	broad	IV	X	C168*	/	* *	B		tripart.	* *	c
T138	168	0.58	broad								tripart.	* *	3A
T139	153	0.58	broad								tripart.	* *	3A
T140	117	0.58	broad								tripart.	* *	3A
T141	54	0.58	broad								tripart.	* *	3A
T142	32	0.58	broad								tripart.	* *	3A
T143	30	0.58	broad								tripart.	* *	3A
T144	13	0.58	broad								tripart.	* *	3A
T145	326	0.58	broad								tripart.	* *	3A
T146	315	0.58	broad								tripart.	* *	3A
T147	303	0.58	broad								tripart.	* *	3A
T148	293	0.58	broad								tripart.	* *	3A
T149	282	0.58	broad								tripart.	* *	3A
T150	269	0.58	broad								tripart.	* *	3A
T151	264	0.58	broad								tripart.	* *	3A
T152	259	0.58	broad								tripart.	* *	3A
T153	257	0.58	broad								tripart.	* *	3A
T154	253	0.58	broad								tripart.	* *	3A
A438	269	1.03	broad	IV	X	C169*	/	* *	B	E097	tripart.	* *	c
A439	241	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A440	223	1.03	broad	IV	X	C170	/	* *	B		tripart.	* *	c
A441	154	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A442	86	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c
A443	205	1.03	broad	IV	X	C171*	/	* *	B		tripart.	* *	c
A444	204	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A445	387	1.03	broad	IV	X	C172	/	* *	B		tripart.	* *	c
A446	384	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c
A447	150	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A448	149	1.03	broad	IV	X	C173*	/	* *	B		tripart.	* *	c
T155	255	0.58	broad							E098	tripart.	* *	3A
T156	71	0.58	broad								tripart.	* *	3A
T157	26	0.58	broad								tripart.	* *	3A
A449	385	1.03	broad	IV	X	C174	/	* *	B		tripart.	* *	c
A450	189	1.03	broad	IV	X		/	* *	B		tripart.	* *	c
A451	166	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c

Coin Data				Aspra						Aspra and Tornesi			
				Gök. gen. type	Bend./ DOC type	Christ Side				Emperor Side			
asp./ tor. no.	Hoard no.	modal wght (g)	wght spread			die	leg.	sym.	Gök. Chr. type	die	bust	sym.	Gök. emp. type
T158	33	0.58	broad							*	tripart.	* *	3A
A452	165	1.03	broad	IV	X	C175*	/	* *	B	E099*	tripart.	* *	c
A453	161	1.03	broad	IV	X	C176*	/	* *	B	E100*	tripart.	* *	c
A454	136	1.03	broad	IV	X	C177*	/	* *	B	E101*	tripart.	* *	c
T159	1	0.58	broad							*	tripart.	* *	3A
T160	285	0.58	broad								tripart.	* *	3A
T161	36	0.58	broad								tripart.	* *	3A
A455	325	1.03	broad	IV	X	C178	/	* *	B	E102*	tripart.	* *	c
A456	89	1.03	broad	IV	X	*	/	* *	B		tripart.	* *	c
T162	62	0.58	broad							E103*	tripart.	* *	3A
A457	173	1.03	broad	IV	X	C179	/	* *	B	*	tripart.	* *	c
A458	221	1.03	broad	IV	X	*	/	* *	B		E104*	tripart.	* *
A459	104	1.03	broad	IV	X	C180*	/	* *	B	tripart.		* *	c
A460	659	n/a	n/a	VIII	IX	C181	/	Б Б	D	tripart.		* *	c
A461	658	n/a	n/a	VIII	IX		/	Б Б	D	tripart.		* *	c
A462	657	n/a	n/a	VIII	IX	*	/	Б Б	D	tripart.		* *	c

In die columns, an asterisk represents coins illustrated in plates 2–3; a Christ die number in boldface represents discontinuity.

### *Aspra and Tornesi of John V Palaiologos*

#### EXISTING TYPOLOGIES

The flagship denomination of John's monetary reform during his sole reign of 1354–1376 might have been the heavy stavraton, or at least it has been presented in this way by modern numismatists. Nevertheless, the main protagonists of the Belgratkapı 1 and 2 hoards and of the reform itself, at least in quantitative terms, were his aspra and tornesi. The literature regarding the latter two denominations is far from clear on this matter: specimens such as those found in the hoards have been attributed to the period of John's return to power after 1379, or to one of his later namesakes (John VII or VIII). The tornesi themselves, apart from being generally considered copper follari as we have just pointed out, have been given little relevance at all to Byzantine monetary affairs, owing to the small number

of specimens which have been preserved, particularly provenanced ones or those from hoarded contexts. Overall, these two denominations have rarely if ever been given their rightful places in John's monetary reform. However, to our minds, owing to their prominence in the two finds, and to the specific results of the die studies, one should begin any analysis of the reform with these denominations.

Thanks to a hoard examined by Bendall,<sup>27</sup> a typology for the aspra in question has already been established. This was also the basis for the exposition contained in *DOC* 5:202. In his study of Belgratkapı 2, Gökyıldırım provided an extended typology for John's aspra, as he did for the tornesi in the context of the Belgratkapı 1 publication. Types and groups have invariably, for the sides bearing the Christ, been created based upon the existence

27 S. Bendall, "A Late 14th Century Hoard of Balkan Silver Coins," *RN* ser. 6, 21 (1989): 183–93.

Table 3. Gökyıldırım's typology of Christ sides of the aspra of Belgratkapı 2.

Gökyıldırım Type	Description
A	no legend, no symbols
B	no legend, * *
C	no legend, • •
D	no legend, B B
E	OCOLLB, no symbols
F	dlLODO, no symbols
G	OCOTIP, • •
H	dlLODO, • •

Table 4. Gökyıldırım's typology of emperor sides of the aspra and tornesi of Belgratkapı 1 and 2.

Gökyıldırım Type		Description
Aspra	Tornesi	
a	3D + 3E	single piece bust, no symbols
b		tripartite bust, no symbols
c	3A	tripartite bust, * *
d	3B	tripartite bust, • •

Table 5. Aspra in Belgratkapı 2 according to Gökyıldırım's typology.

Gökyıldırım Aspron Type	Gökyıldırım Christ Type	Gökyıldırım Emperor Type	Belgratkapı 2 No.	No. of Coins
II	A	a	49–52	4
IX	E	b	660–786	127
III	B	b	53–82	30
X	F	b	787–918	132
XII	H	b	1048	1
XI	G	b	919–1047	129
VI	C	b	429–473	45
XIII	G	d	1049–1221	173
VII	C	d	474–656	183
IV	B	c	83–417	335
V	C	c	418–428	11
VIII	D	c	657–659	3
Others			45–48; 1222–1244	27

Gökyıldırım's type I (A/b) has been omitted here: Belgratkapı 2, nos. 45 and 46, minted from the same Christ die, were originally given a Gökyıldırım Christ type A classification (no symbols and legends). These coins feature as such in table 2 (A043 and A044). However, this reading of the Christ side is doubtful, particularly since the emperor side inserts the coins in a large block of Gökyıldırım type IX coins through die E026. Also the two non-sampled specimens are of very difficult attribution (Belgratkapı 2 nos. 47 and 48). The existence of Type I is therefore uncertain. This reduces the number of Christ type A coins from 8 to 4 (A001–A004). The 4 coins formerly identified as type I have been added to the number of "other" coins at the bottom of this table.

or not of a legend, its orientation, and the symbols in the field. The typology Gökyıldırım established for the Christ sides of the aspra is presented in table 3.

Analyzing the symbols and bust shapes, Gökyıldırım devised two different classifications for the emperor sides in the context of the two hoards and the two denominations, presented in table 4.

The combination of the two typologies (Christ side and emperor side) resulted in an overall typology. Tables 5 and 6 provide break-downs of types according

to the quantities in which they appear in the respective hoards, while some ulterior typological information is contained in the global table 2. Tables 5 and 6 list these types in their order of appearance, which proposes itself by the die study presented in table 2.

The typologies thereby established, for one and the other face of the coin, and the two sides combined, and the overall quantities of specimens, are obviously useful as a general assessment of the developments of these denominations. However, large assemblages such



Table 6. Tornesi in Belgratkapı 1 according to Gökyıldırım's typology.

Gökyıldırım Tornese Type	Gökyıldırım Cross Type	Gökyıldırım Tornese Emperor Type	Belgratkapı 1 No.	No. of Coins
3E	Stars in angles	3D+3E	675–721	47
3D	Dots in angles	3D+3E	497–674	178
3B	Dots in angles	3B	400–492	93
3A	Dots in angles	3A	1–399	399
Others <sup>a</sup>			493–96; 722–1218	501

a. This group of coins contains the rare types 3C and 3Ç, which have not been included in the die study. The briquet on the single specimen of the first of these types (hoard no. 493) cannot be seen with complete confidence.

as those from the Belgrade Gate have revealed certain problems not laid bare by typologies based on much smaller samples, such those of Bendall and *DOC* 5, particularly the fact that certain so-called types are merely the result of free or even incorrect (“muled”) die combinations, or (in the case of aspron type XII) an inconsistency in the engraving affecting one die and specimen in the hoard.

#### THE TYPOLOGIES AND THEIR SEQUENCES IN THE LIGHT OF THE HOARDS

To get to the heart of these coinages, particularly in light of the unique opportunity afforded by these hoards, a full die study became almost inevitable. As explained above, 181 Christ dies (C001–C181) and 104 emperor dies (E001–E104) were found during the die study. It is therefore obvious that the emperor dies were the anvil or, technically, the obverse dies of these two coinages. Any ulterior ordering of specimens and dies had to take this into account and had to revolve around a firm sequence of emperor dies. The order presented in Table 2 is chronologically progressive and respects the logic of types and linked dies. Some specific observations of metrology serve more as corroboration than proof. The sequence does not make the claim of being the only solution: coins of one die, dies with only one or a few specimens, or entire die blocks could be placed elsewhere or inverted without compromising the logic. Nevertheless, this can be done only up to a certain point before types are excessively separated chronologically, and before one must split emperor dies, which should be avoided at all costs. As it stands, all emperor dies have been kept together in the sequence, and only six Christ dies (C018, C065, C078, C095, C138, C140) were split. On the whole there are clearly phases in the production of aspra and tornesi when a so-called open

box system was in place, that is to say, when different Christ dies were freely used for striking. This accounts for the apparently random mixing. The alternative system would have seen single dies used in one long haul until discarded. New typological features, notably the stars in A045, could also rather suddenly be introduced to or taken out of this “box,” rather than being in all cases clearly conceived transitions from one type to the next. In observing types and even styles (or potential hands of die-cutters) one must not forget that our evidence relates to the use of the dies rather than their manufacture. In other words it is conceivable that die production was rather more systematic than their eventual use suggests, and that therefore symbols (sigla) and other typological features related to the former and would have been identifiers or control marks.

Bendall provided a chronology for the aspra he found in the Balkan hoard based on wear and weights. His general scheme moved from specimens with simple legends, to those which are added pellets and stars, and which then omit the legends. Grierson added two types to the end of Bendall's sequence. Table 2 confirms that these types I–X of Bendall/*DOC* are indeed in approximately the right chronological order. Table 2 presents first and foremost a logical sequence based on dies and type developments, and must also bear in mind our findings regarding the stavrata (see below). We were unable to find, as Bendall had done for the hoard which he examined, a greater degree of wear on supposedly earlier aspra of John than on his later ones. There may be good reasons for this—the rather short chronological interval in which they were minted and the fact that they were all already a few years old by the time the hoard was concealed. We found that Gökyıldırım's aspron types all yielded very similar modal weights, at 1.03–1.06 grams. This was clearly a very well calibrated

Fig. 1.  
Weight distribution  
for Gökyıldırım  
aspron type X in  
Belgratkapı 1

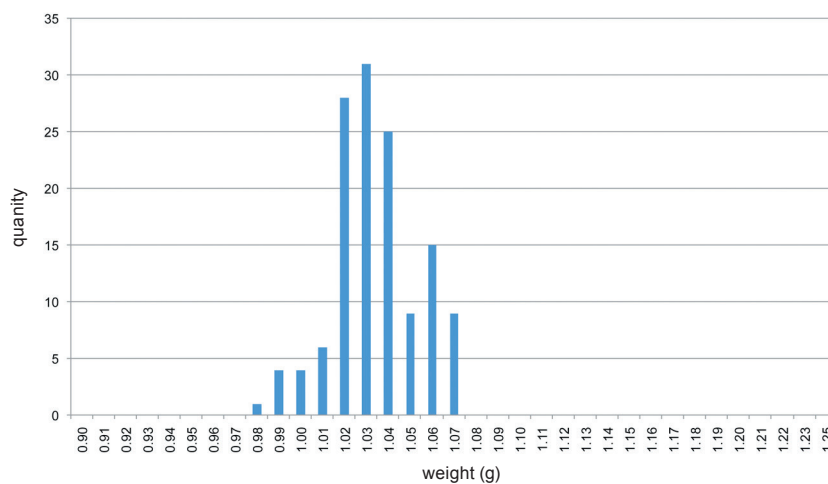


Fig. 2.  
Weight distribution  
for Gökyıldırım  
aspron type IV in  
Belgratkapı 1

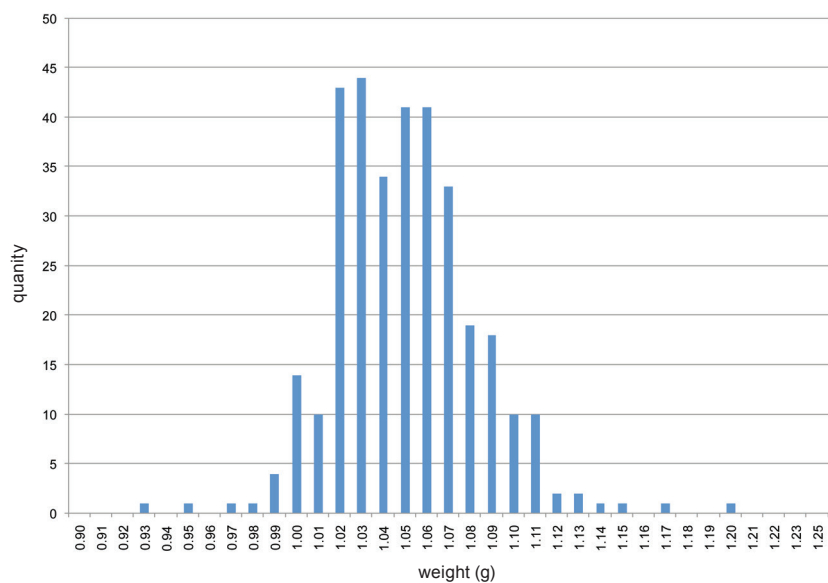
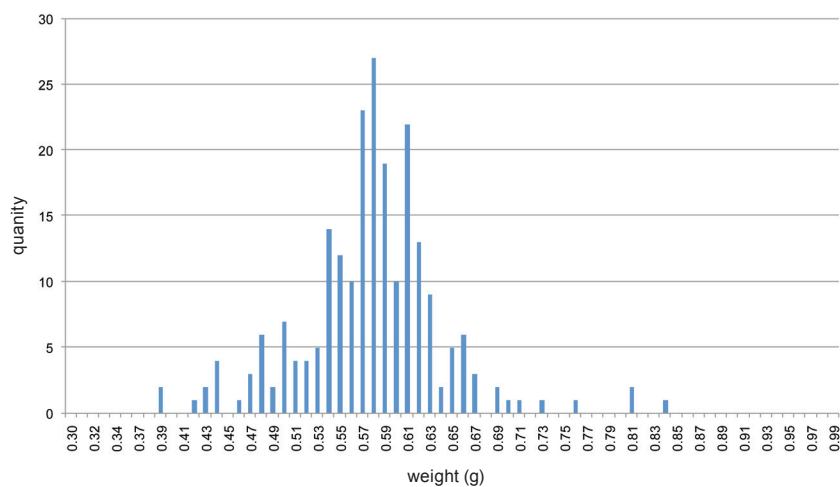


Fig. 3.  
Weight distribution  
for Gökyıldırım  
tornese type 3D+3E  
in Belgratkapı 1



coinage. Nevertheless, we detected a few differences in the frequency tables which we produced for the weights of these types, some being exceptionally well controlled with few weights diverging from the standard (“tight”), while others have a wider middle area and a few coins substantially lighter or heavier (“broad”). Compare figures 1 and 2 for examples of these phenomena, with respectively tight and broad distributions. We deemed that any internal development in the weight standard would logically move from the highest quality of execution to a lesser one.

Table 2 shows that the initial typologies for Christ and emperor were simple, and that a larger number of dies of the latter were used exclusively for tornesi (E005–E021). This was followed by an extensive block of coins/dies which bear a legend for Christ (C005–C109, with intervals). This concentrated period of aspron minting had initially no tornese equivalent, which begins only with E041 (used for aspra in conjunction with C072–C076). Emperors and Christs are simple, the former now tripartite, or gradually surrounded by a pair of pellets in the field. In addition to E041, dies E045, E046, and E050 were temporarily alienated from aspron production and used for the occasional tornese emission. Dies E051–E057 were on the other hand exclusive to tornesi. During the long phase featuring pellets on both sides of the coins the Christ legend is gradually omitted (C109 is the last die with a recognizable legend). Then in due course the pellets are changed for stars, which had made an initial appearance already with C027. During this last phase tornesi are again added to the mint output, with some emperor dies being shared by the denominations (E076, E081, E082, E087, E096–E098, E101, E103), others being exclusive to tornesi (E088–E095). At the very end of aspron production the briquet was added to the field beside Christ (coins A460–A462). As we mentioned above in relation to table 6, the briquet is a doubtful siglon for tornesi.

Tornesi and aspra share therefore typological traits and run in parallel. As in the case of the aspra, weights of tornesi were well adjusted and all of Gökyıldırım’s types produced modal weights of 0.58 grams. We reproduce a frequency table for one of the types in the following figure 3.

To reiterate the point made already in relation to the tornesi of Manuel II from a Lakonian mint, this is the profile of a billon penny-style and not of a fiduciary

copper coinage, because of the care and manpower dedicated to manufacture and control. This pattern furthermore maps completely onto the weight distribution established for Venetian torneselli.<sup>28</sup>

#### QUANTIFICATIONS

The extensive data established in the die studies of the aspra and tornesi lend themselves to further processing through the most up-to-date statistical tools, enabling one to estimate original die data.<sup>29</sup> Esty’s formula can be applied to samples of coins which, as in this case, have been subjected to a complete die study and for which the number of dies and the number of singletons have been established. The purpose of the formula is to provide an estimate—a single point estimate or a range—for the original number of dies which went into the production of the coins represented by the sample. The results are more accurate the higher the coverage (a figure between 0 and 1). This coverage shows the percentage of original dies contained in the sample and expresses the likelihood with which a die match can be found for any new specimens which one may add to the sample. It is to be noted that this is a formula regarding die production and does not in itself make claims to establishing monetary output. For some hypothetical extrapolations in this regard, see the concluding postscript to this paper.

Regarding the Christ side, which is exclusive to aspra, we have the following raw data:

n (number of coins in the sample)	=	462
d (number of dies represented in the sample)	=	181
d1 (number of dies that struck only one coin in the sample)	=	91

This allows one to establish the following:

C <sub>est</sub> (coverage)	=	0.80
D <sub>est</sub> (original number of dies)	=	283

28 A. M. Stahl, *The Venetian Tornesello: A Medieval Colonial Coinage*, Numismatic Notes and Monographs 163 (New York, 1983), 34–35.

29 W. W. Esty, “How to Estimate the Original Number of Dies and the Coverage of a Sample,” *NC* 166 (2006): 359–64.

The latter is merely a point estimate for the original Christ dies. Esty offers additionally a formula for a 95% confidence interval, which result in a  $D_{\text{est}}$  range of 255–314.

For the emperor dies, shared to some extent by aspra and tornesi, the following are the equivalent figures:

$n$	=	624
$d$	=	104
$d_1$	=	39
$C_{\text{est}}$	=	0.94
$D_{\text{est}}$	=	131

The coverage for these dies is better and the point estimate is considerably lower, even though we are dealing with two denominations. Correspondingly, the 95% confidence interval is much tighter at 124–38  $D_{\text{est}}$ . This leaves us to disentangle the two denominations. Of the total number of emperor dies counted in the study (104), 58 were exclusive to aspra (56%), 13 were shared by both denominations (12.5%), and 33 were exclusive to tornesi (31.5%). Assuming that the shared dies were used with equal intensity for both denominations, we can establish for the purpose of output quantifications a  $D_{\text{est}}$  for aspra of 81.5, and a  $D_{\text{est}}$  for tornesi of 49.5. We see that the latter are a coinage of approximately half the size.

#### *Stavrata of John V and Andronikos IV Palaiologoi*

##### TYPOLOGIES AND NEW INFORMATION DERIVING FROM BELGRATKAPI 2

Belgratkapi 2 contained 44 stavrata of John V and 13 of Andronikos IV. Previously, typologies for the stavrata in the names of John and Andronikos focused on weights and the position of the legend on the emperor side. *DOC* 5:201–2 placed more emphasis on overall style, which can most easily distinguish the stavrata in the name of John V for the periods before 1376 and after 1379. This division has been entirely confirmed by the evidence of Belgratkapi 2. Weights can then further help in the separation of issues of John V for 1379–1391 from those of his later namesakes John VII and VIII. Gökyıldırım's typology for John's issues before 1376 is built around five elements: the symbols which surround Christ, the symbols which surround the emperor, the shape of the emperor, the beginning of the legends of the emperor side in either of the two bands, and the precise lettering

of these legends. This typology, in combination with the evidence we have gained from the parallel aspron issues (table 2), is sufficient to suggest a logical sequence, which we have done in the following table 7. The beginning of the sequence is suggested by weights, as we shall see.

Jso1–Jso6 have been placed at the beginning of the series since, in line with the aspra, the emperors are simple. Jso1 and Jso2, which begin the legends on the emperor sides in the outer band, have taken the first two positions on account of their high weights at 8.80 grams and 9.09 grams. The remainder of the coins weigh just in excess of 8.5 grams. Thereafter follow coins with the pellets and star symbols (Jso7–Jso26), which form also the bulk of the aspra. The single coin with the briquet (Js27) has been given the next position. This corresponds to John's last aspron type, but the aspron series lacks the  $\Phi$ , which is well represented in his stavrata (Js28–Js44). There are two reasons for proposing this order, which is otherwise not clarified by the die study since there is a lack of links across types and issues of Emperors John and Andronikos: the figure of Christ on Co26 is stylistically somewhat closer to the main pellet and star varieties (Co07–Co25). The  $\Phi$  denotes Andronikos's early type (Aoo1 and Aoo2) since the one specimen of this emperor in Bendall's hoard belongs to the same type, and because there is an ulterior development in Andronikos' second substantial type not represented in Belgratkapi 2: *DOC* 5: no. 1257 is a stavraton of Andronikos IV of the  $\text{IC} \text{ } \text{XC}$ –type which additionally has pellets on either side of the emperor. As well as confirming the sequence, this type corroborates the 1379 dating we propose for the hoard since there is apparently one final development in the stavraton typology which it failed to incorporate. With regard to the beginning of Andronikos's minting, we can now ascertain that the decision to discontinue temporarily the minting of aspra and tornesi had already taken place during his father's reign. It remains possible that Andronikos began minting stavrata with actual Christ dies made for his father with the  $\Phi$ , although this remains to be proven with the help of specimens not emanating from Belgratkapi 2.

##### QUANTIFICATIONS

In processing further the information of the die study of stavrata we have to separate the issues of John V and Andronikos IV. The readings for John V's Christ dies are entirely inadequate at a coverage of 0.2, so all

Table 7. Stavrata in Belgratkapı 2 according to Gökyıldırım's typology and recording dies.

Stavraton Continuous Numbering	Belgratkapı 2 No.	Gökyıldırım Stavraton Type	Christ symbol	Christ die	Gökyıldırım Christ type	Gökyıldırım Emperor Type	Emperor Die	Emperor Bust	Emperor Symbol	Beginning Emperor Legend	Gökyıldırım Emperor Legend
Jso1	1	J-I	/	Cso1*	J-A	J-a	Eso1*	Single piece haloed	/	Outer band	1
Jso2	2	J-I	/	Cso2*	J-A	J-a	Eso1	Single piece haloed	/	Outer band	1
Jso3	3	J-II	/	Cso3*	J-A	J-a	Eso2*	Single piece haloed	/	Inner band	2
Jso4	4	J-II	/	Cso4*	J-A	J-a	Eso2	Single piece haloed	/	Inner band	2
Jso5	5	J-II	/	Cso5*	J-A	J-a	Eso2	Single piece haloed	/	Inner band	2
Jso6	6	J-II	/	Cso6*	J-A	J-a	Eso2	Single piece haloed	/	Inner band	2
Jso7	7	J-III	• •	Cso7*	J-B	J-b	Eso3*	Tripartite haloed	/	Outer band	1
Jso8	8	J-IV	• •	Cso8*	J-B	J-b	Eso4*	Tripartite haloed	/	Outer band	3
Jso9	9	J-V	• •	Cso9*	J-B	J-b	Eso5*	Tripartite haloed	/	Outer band	4
Jsi10	10	J-VI	• •	Csi10*	J-B	J-c	Eso6	Tripartite simple	/	Outer band	5
Jsi11	11	J-VI	• •	Csi11*	J-B	J-c	Eso6	Tripartite simple	/	Outer band	5
Jsi12	12	J-VI	• •	Csi12*	J-B	J-c	Eso6*	Tripartite simple	/	Outer band	5
Jsi13	13	J-VI	• •	Csi13*	J-B	J-c	Eso6	Tripartite simple	/	Outer band	5
Jsi14	14	J-VII	• •	Csi14*	J-B	J-e	Eso7*	Tripartite haloed	• •	Outer band	6
Jsi15	15	J-VIII	• •	Csi15*	J-B	J-d	Eso8	Five parts haloed	• •	Outer band	7
Jsi16	16	J-VIII	• •	Csi15	J-B	J-d	Eso8	Five parts haloed	• •	Outer band	7
Jsi17	17	J-VIII	• •	Csi16*	J-B	J-d	Eso8*	Five parts haloed	• •	Outer band	7
Jsi18	18	J-VIII	• •	Csi17*	J-B	J-d	Eso8	Five parts haloed	• •	Outer band	7
Jsi19	37	J-XIII	* *	Csi18*	J-E	J-f	Eso9*	Tripartite haloed	* *	Outer band	12
Jsi20	38	J-XIII	* *	Csi19*	J-E	J-f	Eso9	Tripartite haloed	* *	Outer band	12
Jsi21	41	J-XIII	* *	Csi20*	J-E	J-f	Eso9	Tripartite haloed	* *	Outer band	12
Jsi22	39	J-XIII	* *	Csi21*	J-E	J-f	Esi10*	Tripartite haloed	* *	Outer band	12
Jsi23	40	J-XIII	* *	Csi22*	J-E	J-f	Esi11*	Tripartite haloed	* *	Outer band	12
Jsi24	42	J-XIV	* *	Csi23*	J-E	J-f	Esi12*	Tripartite haloed	* *	Outer band	13
Jsi25	43	J-XIII	* *	Csi24*	J-E	J-f	Esi12	Tripartite haloed	* *	Outer band	12
Jsi26	44	J-XIII	* *	Csi25*	J-E	J-f	Esi12	Tripartite haloed	* *	Outer band	12
Jsi27	36	J-XII	Б Б	Csi26*	J-D	J-b	Esi13*	Tripartite haloed	/	Outer band	11
Jsi28	28	J-XI	✠ ✠	Csi27*	J-C	J-b	Esi14*	Tripartite haloed	/	Outer band	10
Jsi29	19	J-IX	✠ ✠	Csi28*	J-C	J-b	Esi15	Tripartite haloed	/	Outer band	8
Jsi30	21	J-IX	✠ ✠	Csi29*	J-C	J-b	Esi15*	Tripartite haloed	/	Outer band	8
Jsi31	22	J-IX	✠ ✠	Csi30*	J-C	J-b	Esi15	Tripartite haloed	/	Outer band	8
Jsi32	23	J-X	✠ ✠	Csi31*	J-C	J-b	Esi16*	Tripartite haloed	/	Outer band	9
Jsi33	24	J-X	✠ ✠	Csi32*	J-C	J-b	Esi16	Tripartite haloed	/	Outer band	9

Table 7. (continued)

Stavrato Continuous Numbering	Belgratkapı 2 No.	Gökyıldırım Stavrato Type	Christ symbol	Christ die	Gökyıldırım Christ type	Gökyıldırım Emperor Type	Emperor Die	Emperor Bust	Emperor Symbol	Beginning Emperor Legend	Gökyıldırım Emperor Legend
Js34	26	J-X	✠ ✠	Cs33*	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js35	20	J-X	✠ ✠	Cs34*	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js36	30	J-X	✠ ✠	Cs35*	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js37	31	J-X	✠ ✠	Cs36*	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js38	25	J-X	✠ ✠	Cs37	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js39	29	J-X	✠ ✠	Cs37*	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js40	27	J-X	✠ ✠	Cs38*	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js41	32	J-X	✠ ✠	Cs38	J-C	J-b	Es16	Tripartite haloed	/	Outer band	9
Js42	33	J-XI	✠ ✠	Cs39	J-C	J-b	Es17	Tripartite haloed	/	Outer band	10
Js43	34	J-XI	✠ ✠	Cs39	J-C	J-b	Es17	Tripartite haloed	/	Outer band	10
Js44	35	J-XI	✠ ✠	Cs39*	J-C	J-b	Es17*	Tripartite haloed	/	Outer band	10
As1	1256	A-IV	✠ ✠	Cs40*	A-B	A-a	Es18*	Tripartite haloed	/	Outer band	4
As2	1257	A-V	✠ ✠	Cs41*	A-B	A-a	Es19*	Tripartite haloed	/	Outer band	5
As3	1245	A-I	Ⓘ Ⓢ	Cs42*	A-A	A-a	Es20	Tripartite haloed	/	Outer band	1
As4	1246	A-I	Ⓘ Ⓢ	Cs43*	A-A	A-a	Es20	Tripartite haloed	/	Outer band	1
As5	1248	A-I	Ⓘ Ⓢ	Cs44*	A-A	A-a	Es20	Tripartite haloed	/	Outer band	1
As6	1249	A-I	Ⓘ Ⓢ	Cs45*	A-A	A-a	Es20	Tripartite haloed	/	Outer band	1
As7	1247	A-I	Ⓘ Ⓢ	Cs46*	A-A	A-a	Es20	Tripartite haloed	/	Outer band	1
As8	1250	A-I	Ⓘ Ⓢ	Cs46	A-A	A-a	Es20*	Tripartite haloed	/	Outer band	1
As9	1251	A-II	Ⓘ Ⓢ	Cs47*	A-A	A-a	Es21*	Tripartite haloed	/	Outer band	2
As10	1252	A-II	Ⓘ Ⓢ	Cs48	A-A	A-a	Es21	Tripartite haloed	/	Outer band	2
As11	1253	A-II	Ⓘ Ⓢ	Cs48*	A-A	A-a	Es21	Tripartite haloed	/	Outer band	2
As12	1254	A-III	Ⓘ Ⓢ	Cs49*	A-A	A-a	Es22*	Tripartite haloed	/	Outer band	3
As13	1255	A-III	Ⓘ Ⓢ	Cs49	A-A	A-a	Es23*	Tripartite haloed	/	Outer band	3

Note: The suffix s added to the C and E indicates stavrata. The issues of the emperors were combined in one table and given continuous die numbers (Cs01–49; Es01–23), although no Christ die of Belgratkapı 2 spans the two reigns.



ulterior calculations become meaningless. For the emperor dies the figures are all the more encouraging:

$$\begin{aligned} n &= 44 \\ d &= 17 \\ d_1 &= 8 \\ C_{\text{est}} &= 0.82 \\ D_{\text{est}} &= 26 \end{aligned}$$

The 95% confidence interval stands at a value of 19–36 for  $D_{\text{est}}$ . According to these estimates we can postulate with some confidence that John V produced about three times as many aspra as corresponding stavrata in the same period. However, much more silver went into the latter given the relationship of these currencies of 8:1.

For Andronikos IV, the figures are again unusable for the Christ dies, but for the emperor dies they are as follows:

$$\begin{aligned} n &= 13 \\ d &= 6 \\ d_1 &= 4 \\ C_{\text{est}} &= 0.69 \\ D_{\text{est}} &= 12 \end{aligned}$$

The 95% confidence interval of  $D_{\text{est}}$  6–24 is broader than ideal. On this basis we may provisionally state that Andronikos produced perhaps fewer stavrata than his father before the latter was ousted in the summer of 1376, perhaps even something approximating the same order of magnitude. This said, we must remember that Andronikos had neither aspra nor tornesi to his name.

### Conclusions:

#### The Dates and Scopes of the Reformed Coinages of John V and Andronikos IV Palaiologoi

##### *The Evidence of the Hoards*

Work on the Belgratkapı 1 and 2 hoards and the accompanying die studies have put us in a much better position to consider the reformed Byzantine currency. We conclude that the Constantinople mint emitted, during a relatively confined period and largely concurrently, stavrata, aspra, and tornesi in the name of emperor

John V. There is no scope in the presented scheme for alienating any blocks of specimens and types from the tightly knit sequence.<sup>30</sup> However, it is very likely that minting began with a very short phase represented by one emperor die (Es01) of stavraton issues at a higher weight standard (between 8.8 g and 9 g per coin rather than the later 8.5+ g). Very soon, the weight of the stavrata was reduced, and aspra weighing precisely 1/8th of the former were introduced. Also tornesi were immediately, or almost immediately, added to the range, and were minted entirely in parallel with the other two denominations, even if their production was perhaps more marked by certain spurts. Some way through the minting of the reformed coinage under John V (after Es13 within John's stavraton series, out of 17 observed, as opposed to calculated, stavraton emperor dies for this emperor) the short-lived briquet siglon was abandoned and the aspron and tornese denominations were discontinued (the latter perhaps somewhat earlier since it was probably already no longer represented during the briquet phase: see above). These nuances allow us to add precision to the estimated relative outputs: out of a total number of 157 calculated dies for John in all denominations, all but six stavraton dies belong to John's first phase, which ends in the briquet. During this first phase, 13% of all the coins were stavrata, 54% aspra, and 33% tornesi. Only a very low percentage of John's total output was minted in the second phase in the form of stavrata. However, once one looks at these figures in terms of bullion rather than coins, the picture becomes less dramatic. Hence, of the actual silver distributed across the denominations in the first phase, just over half went into stavrata. Andronikos continued his father's output, in terms of the main denomination and type. We have projected Andronikos's output and ascertained that it was overall smaller than his father's, especially if we consider the lack of aspra (and tornesi). While we can propose a date for John's monetary reform, which would then help us to establish the relative yearly outputs of the reformed currency under John and Andronikos, we would still require some information or even hypotheses on the duration of John's two phases, in order to gain a real appreciation of the transition taking place around 1376.

30 For such an attempt in the case of the aspra of John V, see for instance Lianta, "Some 'Stavraton' Hoards Re-examined."

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This picture needs to be viewed within a wider monetary and historical framework. To judge by the few data which are available from Constantinople, and from areas around the Sea of Marmara and Aegean Thrace,<sup>31</sup> the decades before John's reform saw substantial quantities of foreign silver specie in use by diverse populations. These are substantially Venetian grossi and later soldini, and Greek deniers tournois, supplemented by Bulgarian grossi of Ivan Aleksandăr with Mihail Asen (from 1331); gigliati of Naples, Provence, Rhodes, Chios, and the Anatolian beyliks (and imitations); akçes of Murad I (from 1360), and even some older western coins such as pennies of Lucca. By contrast, Byzantine coins other than copper from the period of the 1340s and early 1350s, rare in the collections, are almost totally absent from the archaeological record, unless one believed that some of the substantial hyperpyron types in the names of Andronikos II and III were immobilized and minted after 1341.<sup>32</sup> It is for instance noteworthy that Belgratkapı 2 contained no Byzantine silver denominations earlier than John's reform, even if there are issues of Venice going back perhaps as early as 1229 and those of Achaia and Athens

dating to the 1260s–1280s. Even the issues of Rhodes, Chios, Provence, and Bulgaria predate the reform by one to three decades.

Whether or not hyperpyra were minted in any higher quantities by John V and John VI than is currently believed, and leaving aside also the possibility that some Byzantine hyperpyra and basilika of the first half of the fourteenth century were still in use to any significant degree in the beginning of the second,<sup>33</sup> the documentary sources pertaining to the imperial capital reveal an important shift in the account system during these years. In the two most important merchants handbooks of the early decades of the fourteenth century, the so-called Zibaldone da Canal and that of Pegolotti, the Constantinopolitan hyperpyron stood at variable rates to the Venetian grosso (in the region of 1:12.5 to 15).<sup>34</sup> In 1321, in claims made by Venice for incurred losses, the same hyperpyron is valued at 14 grossi,<sup>35</sup> perhaps the same rate suggested by Rhabdas (1341).<sup>36</sup> By the time of Antonio Bresciano (1350) it had already gone down.<sup>37</sup>

Matters were different in Macedonia. Beginning already in the 1280s, according to the Athonite sources, the local hyperpyron of account was the equivalent of 12 grossi (*doukata*), or alternatively one ounce in weight of the latter.<sup>38</sup> This formulation *doukata ouggias* is also

31 In addition to Belgratkapı hoards and Bendall's hoard, which appears to be Thracian (Bendall, "Late 14th Century Hoard"), see, in order of appearance: C. J. M. De Vogüé, "Monnaies et sceaux des Croisades," *Mélanges de Numismatique* 2 (1877): 168–96; A. H. M. Jones, "The Coins," in *Preliminary Report upon the Excavations Carried out in the Hippodrome of Constantinople in 1927* (London, 1928), 46–50; B. Gray, "The Coins," in *Second Report upon the Excavations Carried out in and near the Hippodrome of Constantinople in 1928* (London, 1929), 50; A. R. Bellinger, *Troy: The Coins*, Supplementary Monograph 2 (Princeton, 1961); M. F. Hendy, "The Coins," in *Excavations at Saraçhane in Istanbul*, ed. R. M. Harrison (Princeton, 1986), 1:278–373; idem, "Roman, Byzantine and Latin Coins," in *Kalenderhane in Istanbul*, ed. C. L. Striker and Y. Doğan Kuban (Mainz, 2007), 175–276; H. Köker, "The Roman Provincial, Roman Imperial, Byzantine, Medieval and Islamic Coins from the 1952–3 Excavations at Cyzicus," *NC* 167 (2007): 305–14; J. Baker, "Coins of the Late Medieval Period from Excavations at Ainos (Enez) in Thrace," *NC* 173 (2013): 215–27; O. Tekin, "Excavation Coins and a Byzantine Weight from Küçükçekmece Lake Basin," *Istanbul Araştırmaları Yıllığı / Annual Journal of Istanbul Researches Institute* 2 (2013): 57–66; J. Baker, "Coin Circulation in Late Medieval Thrace According to the Evidence from Edirne Archaeological Museum," *NC* 174 (2014): 245–56.

32 Ponomarev, *Evoljucija* (n. 15 above), 431–67.

33 The continued use of "gold" hyperpyra in the sources is of no consequences in this respect, since these are a money of account (see also above). By contrast, the occasional reference to the "ducatus argenti monete Constantinopolis," computed in pounds, shillings, and pence, and worth 30 to the gold ducat, in the account book of Antonio Barbier is all the more interesting since it suggests the survival of basilika: Bertelè, "Moneta veneziana e moneta bizantina" (n. 9 above), 126. This, as we have just said, is numismatically not verifiable and is apparently directly contradicted by Belgratkapı 2.

34 A. Stussi, ed., *Zibaldone da Canal, manoscritto mercantile del secolo XIV* (Venice, 1967), 67; A. Evans, ed., *Francesco Balducci Pegolotti, La Pratica della Mercatura* (Cambridge, MA, 1936), 40.

35 G. Thomas, *Diplomatarium veneto-levantinum* (Venice, 1880), 1: no. 88.

36 Morrisson, "Les traités d'arithmétique byzantins des XIII<sup>e</sup>–XV<sup>e</sup> siècles, source d'histoire monétaire," *RN* 167 (2011): 171–83, at 174.

37 A. Laiou, "Un notaire vénitien à Constantinople: Antonio Bresciano et le commerce international en 1350," in *Les Italiens à Byzance: Édition et présentation de documents*, ed. M. Balard, A. E. Laiou, and C. Otten-Froux (Paris, 1987), 79–151, nos. 3, 13, 15, 16, 61.

38 The relationships are extensively noted by the various editors of the Archives de l'Athos. See further E. Schilbach, *Byzantinische Metrologie* (Munich, 1970), 181–82; Bertelè, "Moneta veneziana e moneta bizantina," 109; Touratsoglou and Baker, "Grossi," 222–25.

to be found at Serres.<sup>39</sup> For a few decades, therefore, a distinctive Macedonian hyperpyron of account existed beside the metropolitan one, defined by different link coins (Venetian silver grossi rather than Byzantine gold hyperpyra), and of somewhat lesser value.<sup>40</sup> In the same Macedonian body of sources during the 1340s we find exchanges stipulated in *hyperpyra venetika*.<sup>41</sup> These are also without doubt grosso-based hyperpyra, since they are given again in each of the cases ounce-equivalents,<sup>42</sup> and because of the order of magnitude of the documented exchanges.<sup>43</sup> In approximately the same period, Ragusan sources also refer to the same Venetian hyperpyra in Epiros.<sup>44</sup> One of the motivations, in both geographical contexts, would have been to express a clear distinction with the new hyperpyra *de cruce*, based on Serbian grossi.<sup>45</sup> The particular significance of the formulation *hyperpyra venetika* lies in the fact that the hyperpyra themselves are not merely given an equivalent as they had been also previously (for instance 12 grossi or one ounce), but an epithet suggesting another currency. There is, as we have said above, a short step from this formulation to describing the same hyperpyron as “silver.”

39 L. Bénou, *Le Codex B du Monastère Saint-Jean-Prodrôme Serrés XIII<sup>e</sup>–XV<sup>e</sup> siècles* (Paris, 1998), s.v. ouggia.

40 Such a Macedonian/Thessalonican hyperpyron is seldom explicitly defined. However, the Zibaldone da Canal, p. 69, relates such a money of account to the saggio of the light pound of Venice, whereas Pegolotti, p. 176, presents it at Barletta.

41 N. Oikonomides, *Actes de Docheiariou* (Paris, 1984), 180, no. 24 (1345); J. Lefort, V. Kravari, C. Giros, K. Smyrlis, eds., *Actes de Vatopédi*, vol. 2, *De 1330 à 1376* (Paris, 2006), 226, no. 100 (1348).

42 This and its interpretation are correctly noted by Oikonomides on p. 177.

43 The price of a ruined *kellion* is thereby given as 330 hyperpyra in the case of the act preserved at Docheiariou monastery. The editors of the other act presume that this money of account refers to Venetian gold ducats, 100 ounces of which represent the life annuity of a single monk (*hyperpyra venetika ouggias ekaton*). This would result in more than two-and-a-half modern kilograms of gold (100 ounces  $\times$  ca. 27 g), or nearly 800 ducats (= ca. 1,600 hyperpyra of account in this period), an excessively high sum. The alternative, 100 hyperpyra or 1,200 Venetian grossi or 100 ounces (ca. 2.7 kg) of grossi, is on the other hand entirely reasonable.

44 V. Krekić, *Dubrovnik (Raguse) et le Levant au Moyen Âge* (Paris and La Haye, 1961), 192, no. 169 (1335).

45 See above on this accounting system revealed in an act of Chilandar monastery (1348). For the Epirote and Sclavonian area, see for instance L. Thallóczy, C. Jireček, and E. de Sufflay, *Acta et diplomata res Albaniae Mediae Aetatis* (Vienna, 1913), 1:222, no. 745 (1330); 1:225, no. 757 (1332); 1:234, no. 789 (1335); 1:239, no. 804 (1336).

This tendency to embrace fully the fact that hyperpyra were a grosso-based standard through nomenclature provides therefore a very reasonable explanation for the silver hyperpyra of the will of summer 1367, which was so central to Grierson’s dating of the stavraton.

During the same period (1340s–1360s) the metropolitan hyperpyron of Constantinople became cheaper than previously, but also more consistent in terms of the main international currencies, 1:12 to the Venetian silver grosso and 2:1 to the Venetian gold ducat.<sup>46</sup> This state of affairs might not have been expected given the tribulations of the Byzantine monetary system. After all, by the time of the sole rule of John V the Constantinople mint produced few if any fine metal coins. It appears therefore very likely, whatever one may conclude about the existence of Byzantine specie in the same years ca. 1340s–1360s, that the Constantinopolitan hyperpyron of account shifted to a non-Byzantine link coin already during this interval. This could have been only the Venetian grosso, in the light of the coin finds referred to above, the rate of exchange, and the Macedonian experience. In other words, in this period the Macedonian and metropolitan hyperpyra, which had intermittently drifted apart, were once again united to a single standard, representing the equivalent of  $12 \times 0.965 \times 2.18$  grams = 25.24 grams of silver, or even 26 grams if one applied the equivalent of one ounce of grossi to the hyperpyron.<sup>47</sup> Grossi and, later as we shall see, stavrata and their fractions largely unified the Macedonian and metropolitan monetary standards for the remainder of the medieval period, yet it is still possible that intermittently there were discrepancies of definition and value due to the reliance on different link coins.<sup>48</sup>

46 Bertelè, “Moneta veneziana e moneta bizantina” (n. 9 above), 45–46 and 124.

47 N. Papadopoli Aldobrandini, *Le monete di Venezia* (Venice, 1893), 1:86.

48 This is suggested for instance by the existence of so-called Thessalonican ingots, two of which according to a document from the 1380s weighed 22 pounds and 2 ounces. The same relates also that a pound of silver was worth 19 hyperpyra: C. Morrisson and T. Ganchou, “‘Lingots de Thessalonique’, *stavratati de conto et sommi de Trébizonde*,” *RN* 165 (2009): 163–85, at 165 and 167. We must assume, because of the nature of the document, that hyperpyra and pounds (324.7 modern grams) were metropolitan, unlike the two ingots, which gives us a combined modern equivalent for the latter of 7,197.4 g. This results in a rather crooked value (a bit more than 22 hyperpyra), from which we may infer in the very least that these

The Neapolitan *gigliato*, the other significant western fine silver coin available in the region in mid-century, had a theoretical silver content of  $0.929 \times 4.009$  grams = 3.73 grams.<sup>49</sup> Our knowledge of the *gigliato* in the Aegean and southern Balkans is still sketchy. The written sources, as we have said, are not very useful in pinpointing either the absence or the presence of this currency, nor do they give us an explicit exchange rate to the gold hyperpyron in any particular period. Recent research into the hoards from Miletos and Ephesos has placed new emphasis on the 1350s–1360s as the key periods of *gigliato* availability in terms of imports and production at Rhodes, Chios, Ephesos, and Miletos.<sup>50</sup>

*Gigliati* gained in prominence exactly at the time when the importance of the presence of the Venetian *grosso* began to wane: note that the last *grosso* issue in Belgratkapı 2 dates at least two and a half decades before the reform of John V, and that the coinage itself ceased to be minted during the dogeship of Andrea Dandolo (1343–1354). The presence of 201 soldini in Belgratkapı 2, with heavy concentrations for Doges Francesco Dandolo (1329–1339) and Giovanni Dolfino (1356–1361), underlines further a possible move away from a standard based on actual *grosso* coins: according to the new Venetian “moneta” system of account a *grosso* was the equivalent of three soldini.<sup>51</sup> The appearance of this coin led to a progressive cheapening of other hyperpyra of the Aegean region, for instance that of Negroponte/Thebes and the Peloponnese.<sup>52</sup> We do not have positive proof that such constructs actually existed, but it is well imaginable that in certain contexts Constantinopolitan hyperpyra of 12 grossi were met for instance with type 2 (1353–1369) and

type 3 (1369–1379) soldini, resulting in silver totals of ca. 20 grams and ca. 19 grams.

The last element in this puzzle is constituted by Ottoman coinage. At Pera and Gallipoli Barbier recorded sums for smaller purchases (biscuits and beans) in aspers.<sup>53</sup> At 32 to the gold ducat, these are 2.25 times more valuable than the soldino (72 to the ducat), type 2 of which being the equivalent of ca. 0.55 grams of silver. There can be no doubt that these aspers are Ottoman *akçes*. These citations, in conjunction with Belgratkapı 2 itself, are significant pieces of information regarding the diffusion of this currency in the metropolitan area. In fact, because of its size and date, our hoard is of primary importance in understanding coin production under Murad. Our forthcoming publication will contain a full treatment of the 133 *akçes* of the sultan: they are limited to Srećković’s nos. 1–6 or Ehlert’s first and second series.<sup>54</sup> The coins, which do not in themselves bear any dates, end apparently in issues with the double lines with a central dot, which according to the usual interpretation brings us toward the end of Murad’s second decade of rule, that is to say, close to the concealment date of the hoard itself. The earliest types are quite rare in the hoard as much as elsewhere, which is testimony to the much more modest scale of the Ottoman silver currency during the 1360s, as it had been under Orhan before 1361.<sup>55</sup> The 133 coins produced a modal weight of 1.18–1.19 grams.

For convenience, the different hypothetical metropolitan hyperpyra based on different link coins from mid-century to John’s reform are summarized here in terms of their fine silver equivalents in modern grams:

1 ounce of Venetian grossi	= ca. 26 g
12 Venetian grossi	= 25.24 g
36 Venetian soldini of type 2	= ca. 20 g
36 Venetian soldini of type 3	= ca. 19 g
16 Ottoman <i>akçes</i> of the 1360s	= ca. 19 g
4 Neapolitan <i>gigliati</i>	= 14.92 g

Thessalonican ingots, which one would assume were of equal weight, did not adhere to a Constantinopolitan standard.

49 P. Grierson and L. Travaini, *Medieval European Coinage*, vol. 14, *Italy*, pt. 3, *South Italy, Sicily, Sardinia* (Cambridge, 1998), 220.

50 J. Baker and B. Kluge, “Der *Gigliati*-Schatzfund aus den Ausgrabungen der Berliner Museen in Milet (1903), verborgen um 1370/74,” *Numismatische Zeitschrift* 122–23 (2017): 367–94; J. Baker, “A Reassessment of Wood’s 1871 Artemision Hoard of Fourteenth-Century Coins,” in *Ephesos from Late Antiquity to the Later Middle Ages*, ed. S. Ladstätter and P. Magdalino (Leuven, forthcoming).

51 On the new Venetian denominations and accounting systems of the early 1330s, see Stahl, *Zecca* (n. 4 above), 41–68.

52 On the soldino specifically in these areas, see idem, “The Cephalonia Hoard of Venetian and Hungarian Coins,” *Nomismatika Chronika* 13 (1994): 85–102.

53 Bertelè, “Moneta veneziana e moneta bizantina,” 135–36.

54 S. Srećković, *Akches* (Belgrade, 1999), 1:32; R. Ehlert, *Umlaufgeld im Osmanischen Reich* (Heidelberg, 2013), 1:54–55.

55 See in the latest instance N. Schindel et al., “Zur Münzprägung des osmanischen Sultans Orhan (ca. 1324–1361),” *Mitteilungsblatt, Universität Wien, Institut für Numismatik und Geldgeschichte* 46 (2013): 18–23.



*The Monetary Reform of John V*

## PROTOTYPES FOR THE STAVRATA AND ASPRA

There can be little doubt that John's new reformed silver denominations were modeled on two *gigliati* and *akčes*, even though in neither case are the Byzantine issues faithful metrological equivalents of their prototypes. The new Byzantine denominations were ca. 0.95 fine,<sup>56</sup> resulting for the short-lived heavy *stavrata* in *hyperpyra* of account of ca. 18 grams silver, for the subsequent *stavrata* and *aspron* issues in *hyperpyra* of ca. 16 grams. The latter is substantially lower than the standard of the *hyperpyron* based on Venetian *grossi*, and still a bit lower than a *hyperpyron* based on type 3 *soldini*, or on *akčes*: Ponomarev, who had slightly underestimated the weight of Murad's issues based on the evidence of another hoard, concluded that the silver contents of Ottoman and Byzantine *aspers* were near equal.<sup>57</sup> However, the new *hyperpyron* was higher than a possible *hyperpyron* based on four *gigliati*. We can deduce therefore that overall the Byzantine authorities were evidently required to incorporate more than one foreign silver denomination and to strike a metrological compromise between them, while operating in a context of a general rise in the value of silver.<sup>58</sup> It is also likely that the Byzantines were purposefully cheapening the standard. Ponomarev introduced another consideration, namely the desire to cut *aspra* in round figures from the pound, namely 300. Whatever the case may have been, the evidence developed by Ponomarev points not so much to a move away from gold as the standard of the *hyperpyron* at the moment of the reform, and rather to a shift from a *grosso*-based *hyperpyron* to one linked to much lesser silver link currencies.

## THE TORNESE AND ITS INTENTIONS

In his reform John made the audacious attempt, inspired by Venetian practice,<sup>59</sup> to constitute the Constantinopolitan *hyperpyron* in another manner: through low-grade billon *tornese* based on the Venetian *tornesello*. According to some sources, this coinage stood in a regular relationship to the *aspron* at 12:1; in

other words, 192 *tornesi* were the equivalent of a *hyperpyron*.<sup>60</sup> The metrology of this currency is naturally not particularly well understood, but these coins may well have been overvalued by about four hundred percent. The Venetian *tornesello* was introduced in 1353 to service Venetian colonial interests primarily in Crete, Coron-Modon, and Negroponte. It gained use gradually as other denominations were phased out, notably *soldini* and *deniers tournois*, and as the Venetian empire expanded into new areas in the face of Ottoman advances. It remained in many respects a classic Aegean coinage, so that in the Byzantine north it is natural to find it in Rentina, Thasos, or Lesbos, but not in interior Macedonia or Thrace.<sup>61</sup>

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In considering now the date of John's monetary reform, one would need to postulate that in general terms all described monetary developments suggest a date which is late within the possible time frame 1367–ca. 1372: the coins which inspired the new Byzantine denominations, *gigliati*, *akčes*, and *torneselli*; the demise of the Venetian *grosso*; and developments in the value of silver, which would have made a new and debased *hyperpyron* of account viable. Further, we have seen that all the analyzed issues of the two emperors formed one block with two layers: the *stavrata* create a direct link between John and Andronikos, while for an initial phase John minted great quantities of *tornesi* and *aspra* in parallel with *stavrata*. The denominations are also linked by similar sigla. For these reasons one must find an uninterrupted period of *stavrata*, *aspron*, and *tornese* minting in the name of the emperors which works its way backward in time from the fixed points 1379 and the summer of 1376. In other words, the numismatic data would not allow one to postulate

56 *DOC* 5:250.

57 Ponomarev, "Monetary Markets of Byzantium" (n. 15 above), 607–8.

58 P. Spufford, *Handbook of Medieval Exchange* (London, 1986), 63.

59 Stahl, *Tornesello* (n. 28 above).

60 C. Morrisson, "Coin and Exchange Rates in Badoer's 'Libro dei Conti,'" *DOP* 55 (2001): 217–45, at 221.

61 J.-M. Saulnier, "Thasos à l'époque paléochrétienne et byzantine: Étude de numismatique et d'histoire" (PhD thesis, Paris, 1992); M. Galani-Krikou and I. Tsourti, "Μακεδονική Πενίνα: Η νομισματική μαρτυρία (ανασκαφές: 1976–1996)," in *Το νόμισμα στο Μακεδονικό χώρο* (Thessalonike, 2000), 347–54; H. Williams, "Medieval and Ottoman Mytilene," in *Medieval and Post-Medieval Greece: The Corfu Papers*, ed. J. Bintliff and H. Stöger (Oxford, 2009), 107–14.

any more extended and less concentrated minting, let alone a minting in two distinct phases. One must also regard it as likely that any dramatic changes to minting at Constantinople would have to have taken place in the presence of the emperor in the capital, which was not the case for most of 1369–1371. Finally, the Ottoman akçe was of all the discussed coinages the most recent arrival in the empire, and also the one least integrated with all the other denominations. The decision by John V to dedicate nearly half of his silver resources to aspra during the initial minting phase after the reform must be explained with reference to special circumstances. This impression of extraordinariness is further underlined by the fact that this coinage has barely left any archaeological record. It is present merely in the two hoards which have been discussed,<sup>62</sup> and is apparently absent from sites, despite being issued in good quantities and having the typical physical properties of coins which might be occasionally lost during everyday activities. These considerations suggest in the strongest terms that John reformed the coinage in ca. 1372, in direct relation with the formal peace concluded with Murad. John V Palaiologos introduced almost concurrently three new denominations at the Constantinople mint, the silver stavraton and aspron, and the billon tornese. These related to current denominational developments in the empire, but particularly the desire to put the hyperpyron of account on a new and less valuable footing, and the requirement of making substantial payments to the Ottomans in a compatible currency. Production in ca. 1372 and immediately thereafter was high. Many of the aspra produced during these years would have been used for payments to Sultan Murad, or for expenditures required in the context of the joint campaign. The numismatic data do not allow us to conclude when the second phase of John's minting might have begun, and consequently whether and how much less was minted per annum during this phase, and therefore also how much of a break in the minting pattern took place during the transition from John to Andronikos. We would also not be able to conclude from these data when and if at all such tributary payments to the Ottomans may have ceased temporarily. Any number of scenarios remain plausible, for instance, that during the last phase of John's minting and during the reign of Andronikos money flowed

from the empire to the Ottomans in the form of previously minted Byzantine aspra, or indeed in the shape of other Byzantine or foreign denominations.



### Postscript: The Historical Essence of the Reformed Coinages of John V and Andronikos IV

With this paper we set out to date and describe the new Byzantine silver coinages of Emperors John V and Andronikos IV. One may consider these findings to be central ingredients to any fiscal or monetary history of the empire particularly for the 1370s, although this requires some testing. Any endeavor to write such a history would need a protracted course of argumentation, made more difficult by a general vagueness of the available information and by specific uncertainties regarding some of the central questions. These relate to the possibility of quantifying any further coin production; of describing the kind of balance of payments which Constantinople and its surroundings might have enjoyed; and the extent of the tributary relationship with the Osmanlis and the financial support received from Venice. Further, we are largely ignorant about the budgetary possibilities of the empire, either regular or emergency, and how this might have been affected by the dynastic conflict in this decade and by the Genoese involvement. In the light of this picture we can offer here little more than some preliminary reflections on the possibilities afforded by the new data.

#### *The Size and Impact of the Reformed Coinages in Their Historical Contexts*

For the period ca. 1372 to summer 1376 there were, for the sake of the argument, an estimated 81.5 aspron and 26 stavraton emperor dies. An estimate of 10,000 coins per obverse/anvil die is very conservative, but would produce in terms of bullion ca.  $81.5 \times 10,000 = 815,000$  and  $26 \times 8 \times 10,000 = 2,080,000$  (total: 2,895,000) grams of silver. For the period from summer 1376 to a point close to 1379 we arrive in the same fashion at  $12 \times 8 \times 10,000 = 960,000$  grams of silver. Overall, the per annum production for Andronikos was significantly lower than that of John. It is nevertheless imaginable that production for the earlier emperor was perhaps

62 Lianta, "Some 'Stavraton' Hoards Re-examined" (n. 4 above).



on an order of magnitude of that of Andronikos by the time of the regime change in 1376, and that therefore the period in which the alliance with Murad was sealed and the Anatolian campaign took place saw much higher per annum production. Any greater precision in this respect will be impossible to achieve. In the same initial period John minted according to the same system of estimate nearly 500,000 tornesi. The resulting ca. 2,500 hyperpyra of account in tornesi (many more if you believe in a higher per die output and a larger overvaluation of the individual coins) would hardly have been used for any payments toward the Turks, but perhaps, as in the Venetian colonies, to remunerate lower-ranking civil servants or to purchase products and services for the empire. Despite the inherent problems of this coinage, it has the archaeological hallmarks of being much more successful than the aspron, present at many of the described sites, and in some hoards (see also appendix 1), of the northern Aegean, while representing to our knowledge the only denomination of the Constantinople mint for the period ca. 1372–1453 found in the southern Aegean (specifically at the Kraneion basilica in ancient Corinth, in the shape of an unpublished specimen). This coinage was revived in 1391 by Manuel II, who may even have given it more stature by increasing its rate of production and perhaps its silver content, and by expanding its mintage to the Peloponnese.

*The Balance of Payments of Constantinople  
and Surroundings before the Reform*

In the period immediately preceding our own, gold was draining out of the Byzantine empire, particularly toward the eastern Balkans, where it might have been used to acquire foodstuffs for the imperial capital.<sup>63</sup> Nevertheless, there seems to have been a steady stream of silver toward both Macedonia and Thrace from the late thirteenth century. This led in different phases to the incorporation of the grosso standard into the domestic systems, the minting of basilika, and then in mid-century to the creation of more diverse standards based on a newer generation of imports. Beside the coinages which have already been discussed one cannot fail to mention the Bulgarian grossi, which according to western sources, for instance Genoese notaries and Antonio Barbier himself, were beginning

to attain an interregional profile in their accounted form (hyperpyra of Mesemvria) in precisely the period of interest.<sup>64</sup> As we shall demonstrate elsewhere, many of the 331 specimens of Belgratkapı 2 were, according to the established typology,<sup>65</sup> minted into the 1360s. It is undeniable that Constantinople and its surroundings were enjoying a positive balance of payments with different areas and polities in this period: the Ottomans and Anatolian beyliks, parts of the Balkans and Greece, and also the Latin west. Whatever one may decide about the reasons for this and the precise technicalities of John's reform, it is undeniable that it took place in this context, and need not by necessity have built on much earlier silver coinages such as basilika and Venetian grossi.

*Extraordinary Budgetary Conditions  
during the Period of the Reform*

The loan John V might have received from Venice in 1371, according to one interpretation, of 30,000 ducats amounts to 720,000 grossi or  $720,000 \times 0.965 \times 2.18 =$  ca. 1,600,000 grams of silver. This is on the same order of magnitude as John's reformed silver coin production at the Constantinople mint. This confrontation of the figures serves a useful purpose, that of demonstrating that the new Byzantine coinage of the 1370s may well have been supported by a confined and one-off injection of cash rather than being necessarily the product of a sustained fiscal effort. We know next to nothing about the extent of the possible tribute to the Osmanlis and related payments in the course of the 1370s. The "gold coins," 30,000 of which were revealed by Chalkokondyles to have been the annual payment after the summer of 1379, cannot possibly have been Byzantine gold hyperpyra as supposed by Iliescu. If one wanted to deduce anything from this information at all, we would suggest that these were either ducats/florins or hyperpyra of account, worth in this period less than half of these major Italian coin coinages. Whatever the case may have been, this yearly expenditure is again revealed to be on the same order of magnitude as the other established figures.

64 Bertelè, "Moneta veneziana e moneta bizantina" (n. 9 above), 130–31; O. Iliescu, "Étalons pondéraux et monnaies de Mesembrie au XIV<sup>e</sup> s.," *Byzantinobulgarica* 7 (1981): 469–72.

65 Especially that contained in J. Jurukova and V. Penčev, *Bălgarski srednovekovni pečati i moneti* (Sofia, 1990).

63 See for instance D. M. Metcalf, *Coinage in South-Eastern Europe 820–1396* (London, 1979), 280–84.

*Byzantine and Non-Byzantine Coins in Constantinople and Surroundings during the Period of the Reform*

Leaving aside the uncoined metals, the Belgratkapı 2 hoard contained somewhat less than three modern kilograms of coins. Only about sixty percent of this mass was represented by Byzantine coins, the remainder being foreign coins, mostly Bulgarian, Venetian, and Ottoman. We have no way of knowing how typical this picture is for the imperial capital during the 1370s, or whether it is more of a reflection of the status and activities of the owner and concealer. Also our information from the surrounding areas is less than satisfactory. To judge by a number of hoards and stray finds from the wider Thracian area (see note 31 above) the contemporary local population would have intermittently used and deposited exclusively, or in combination, Bulgarian, Venetian, or Ottoman coins, much more frequently than Byzantine coins. There is an interesting precedent to give here, which has already been cited in this paper: the Macedonian system of account for the period 1280s–1340s was heavily dominated by the Venetian grosso, a coinage which also prevails in the local hoards. There is no real evidence that Byzantine gold and silver coinage was present there to any great degree in the first half of the fourteenth century. The supposed hyperpyron issues of the local mint under Andronikos II are also of doubtful identification, as is a very small basilikon issue assigned to Thessalonike.<sup>66</sup> Here we find therefore an important and extended area within the Byzantine empire in which during a sustained period the authorities were content to conduct many of their major affairs with a foreign coin, and where no attempt was made to convert the available bullion into an imperial coinage which could be better dominated and regulated, and from which further profit could be drawn in the shape of seigniorage.<sup>67</sup>

*Hypothetical Conclusions*

Seeking to understand John's coinage reform in ca. 1372 via the empire's fiscal policy, or even its positive balance of

payments, may in fact prove to be a red herring. The aspron in particular, from a number of angles, appears to have been minted in addition to the usual monetary policy—or lack of it—pursued by the administration, which gave considerable space to nonimperial specie. Of the three new denominations, the tornese might have been the one most beneficial to the empire's regular ongoing expenditure, albeit initially on a modest scale. The new silver coinage of John V, and perhaps of Andronikos IV, which in overall budgetary terms may have been quite modest, might in turn have been minted from extraordinary resources, and disposed of to a large degree in payments outside of the usual fiscal cycle, leaving in turn in this early postreform period relatively little impact on the specie used by the average Byzantine. Far from representing a renewal of the monetary system used in Byzantium, the coinage reform of ca. 1372 underlines emphatically that this system was to a large degree based on coins of non-Byzantine mintage.

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66 C. Morrisson, "The Emperor, the Saint and the City: Coinage and Money in Thessalonike from the Thirteenth to the Fifteenth Century," *DOP* 57 (2003): 173–203.

67 On the organization and principles of minting in the Palaiologan period, see K.-P. Matschke, "Münzstätten, Münzer und Münzprägung im späten Byzanz," *RN* 152 (1997): 191–210.

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## Appendix 1

### *A Tornese Hoard from Lemnos*

A recent publication has presented a hoard from the island of Lemnos in the northern Aegean. Of its six coins, which we call here tornesi, one bears the Christ-in-mandorla/standing emperor type in the name of Manuel (see *DOC* 5: nos. 1603–9), and the other five, the same iconography as the tornesi contained in Belgratkapı 1 (bust of Christ/cross patty).<sup>68</sup> Of the latter, three are in the name of Manuel (*DOC* 5: no. 1610), one is in the name of John, and another has an illegible name. The coin in John's name was attributed to John VII or VIII and the hoard was dated to a certain point in the first half of the fifteenth century. However, the two tornesi other than those in the name of Manuel bear a very close resemblance to one another and to the tornesi contained in Belgratkapı 1, so that we can assume that these, too, are to be attributed to John V during the period ca. 1372–76. The specimens are not particularly well preserved, but one of the coins in John's name seems to feature a tripartite emperor bust with stars on either side (Gökyıldırım's tornese type 3A, see Table 4).

The Lemnos hoard is very significant indeed in clarifying the sequence of tornese issues of the Constantinople mint.<sup>69</sup> It lacks the Christ-in-mandorla/

standing emperor type in the name of John (*DOC* 5: nos. 1391–93), which can therefore be confirmed as an issue of John VII (1399–1403). For this reason the general shift to the Christ-in-mandorla type can be dated to the early years of Manuel's reign (1391–1399) as can in all likelihood the parallel creation of a Lakonian tornese of the same type in the name of Manuel. The Lemnos hoard is therefore of the following composition:

- John V Palaiologos, bust of emperor/cross patty type, minted 1372–76, 2 specimens
- Manuel II Palaiologos, bust of emperor/cross patty type, minted 1391–mid 1390s, 3 specimens
- Manuel II Palaiologos, Christ-in-mandorla/standing emperor type, minted mid-1390s–1399, 1 specimen

The Lemnos hoard is thereby dated in all likelihood to the late 1390s, a particularly dramatic period for the empire in which the island was gaining in strategic importance.<sup>70</sup>

68 T. Kourempanas, “‘Θησαυρός’ χάλκινων νομισμάτων των τελευταίων Παλαιολόγων από τη Λήμνο,” in *Ολοκότινον: Μελέτες Βυζαντινής Νομισματικής και Σιγilloγραφίας στη μνήμη του Πέτρου Πρωτονοταρίου*, ed. G. E. Papaethymiou and I. P. Touratsoglou (Athens, 2013), 129–33.

69 Confirming thereby the hypothesis of Baker, “Manuel II Palaiologos” (n. 3 above), 409–10.

70 P. Topping, “Latins on Lemnos before and after 1453,” in *Continuity and Change in Late Byzantine and Early Ottoman Society*, ed. A. Bryer and H. Lowry (Birmingham, 1986), 217–33, at 221.

## Appendix 2

### *XRF Analyses of Constantinople Tornesi in the Collection of the Ashmolean Museum, Oxford*

KELLY DOMONEY

From the Ashmolean Museum, five tornesi of the Constantinople mint were analyzed to verify their status in the denominational spectrum of Byzantine coinage after the reform of John V (Lianta nos. 1019–20, 1050, 1093–94).<sup>71</sup> The coins are listed in table 8 following the order of their issuers according to the latest sequence (see especially the discussion in appendix 1).

An Oxford Instruments X-MET 8000 handheld X-ray fluorescence spectrometer with a 5-mm beam

running at 40 kV and 8  $\mu$ A was used for all analyses. Four 60-second measurements were taken across the surface of each tornese and the results averaged. MBH copper alloy standards 32X LB17, 32X SN7, and 33X GM20 were used to check the accuracy of the instrument. Average errors by element are Fe  $\pm$  0.1, Ni  $\pm$  0.1, Cu  $\pm$  2.5, As  $\pm$  0.2, Ag  $\pm$  0.02, Sn  $\pm$  1.2, Sb  $\pm$  0.3, and Pb  $\pm$  1.4. Results show that all five tornesi contain silver in the range of 2–7%.

Table 8. XRF results of five tornesi from the Ashmolean Museum

Issuer	Type	Elemental weight, % average ( $\sigma$ ) <sup>a</sup>								
		Lianta no.	Fe	Ni	Cu	As	Ag	Sn	Sb	Pb
John V Palaiologos	bust of emperor / cross party	1050	0.6 (0.1)	0.1 (0.0)	95.1 (1.4)	0.3 (0.2)	2.3 (0.1)	— <sup>b</sup>	— <sup>b</sup>	1.4 (0.9)
Manuel II Palaiologos	Christ-in-mandorla / standing emperor	1019	0.1 (0.0)	0.1 (0.0)	94.9 (0.0)	0.2 (0.0)	3.7 (0.0)	0.4 (0.1)	0.1 (0.0)	0.4 (0.1)
Manuel II Palaiologos	Christ-in-mandorla / standing emperor	1020	0.2 (0.1)	0.2 (0.0)	91.7 (0.4)	0.3 (0.0)	6.8 (0.2)	0.1 (0.1)	0.1 (0.0)	0.5 (0.1)
John VII Palaiologos	Christ-in-mandorla / standing emperor	1093	0.3 (0.2)	0.1 (0.0)	91.5 (0.9)	0.5 (0.2)	5.6 (0.3)	0.2 (0.0)	0.2 (0.0)	1.4 (0.5)
John VII Palaiologos or later emperor	Christ-in-mandorla / standing emperor	1094	0.4 (0.2)	0.1 (0.0)	95.6 (0.2)	0.3 (0.0)	2.4 (0.3)	0.2 (0.1)	0.2 (0.0)	0.7 (0.0)

a. Average based on four analyses;  $\sigma$  = standard deviation

b. Element below detection

71 E. Lianta, *Late Byzantine Coins 1204–1453 in the Ashmolean Museum, University of Oxford* (London, 2009).

## Appendix 3

### *XRF Analyses of Tornesi of John V from Belgratkapı 1 in the Collection of the Istanbul Archaeological Museum*

TUĞÇE PAMUK AND IRMAK GÜNEŞ YÜCEİL

Five coins from the Belgratkapı 1 hoard had previously been identified by Gökyıldırım as silver washed or plated.<sup>72</sup> The coins in question are nos. KD1355/1 (E101 and T159 of the die study; pl. 3), 2 (T137 of the die study), 79, 331, and 332 (pl. 1, no. 14). On 18 January 2016 the Directorate of Istanbul Archaeology Museum requested that the metallic compositions of these coins be determined by XRF analyses. These were conducted on 4 February using a DS-2000 Olympus Innov-X Systems type handheld device with the serial number 500698 and belonging to the Directorate of Central and Regional Laboratory for Restoration and Conservation. Measurements of 60 seconds were conducted in precious metal mode. To obtain data from different points and to have more reliable results, each coin was scanned three times on each side, resulting in six lines of elements for each coin.

The measurements revealed that the surface of coin no. 332 has 70% copper and up to 25% silver. On the other hand, it has been seen that coins 1 and 2 contained around 3% silver on their surfaces. This shows that the first of these was coated in silver whereas the other two coins were copper and silver alloys. No silver

was detected on the surfaces of coins 79 and 331. It was observed that these two coins contained copper, tin, aluminum, and silicium. Therefore it can be concluded that these two coins were made of bronze and other elements (=minerals), detected beside copper and tin, because of impurities, because of corrosion on the surface, or as a result of contamination from soil, dirt, or other materials present in the environment.

Handheld XRF devices are preferred for the analysis of archaeological objects because they are not destructive. It is known that the results can differ according to the model of the device as well as the mode used. It should also be noted that the results are based on rays that do not penetrate the surface of the coin very deeply and so may not reflect the actual metal content of the coin. Moreover, corrosion (and any kind of dirt) on the surface also affects the results. It would be possible to acquire more accurate information if the above-mentioned coins were examined in more detail under a microscope and scanned. Also we would obtain more accurate data about the metal content of the coins believed to be coated with silver once corrosion on the surface is removed and they are scanned again by XRF.

72 See n. 25 above.



Table 9. XRF results of five coins from the Belgratkapı 1 hoard.

Inv. No.	Side <sup>a</sup>	Test No.	Elemental Weight, % Average														
			Cu	Ag	Sn	Al	Si	P	S	Ti	Mn	Fe	Ni	Zn	Sb	Au	Pb
332	e	4	52.03	21.33	0.31	6.84	16.22	0.95	b	0.07	0.01	0.55	0.01	0.35	0.28	0.12	0.87
332	e	5	53.06	21.24	0.33	6.50	15.51	0.97	b	b	0.01	0.63	0.01	0.33	0.28	0.11	0.93
332	e	6	55.11	21.84	0.38	5.33	13.86	0.91	b	0.12	0.02	0.64	0.01	0.28	0.28	0.12	1.03
332	c	7	69.31	25.50	0.37	b	1.29	0.37	b	0.18	0.02	0.37	0.04	0.34	0.34	0.14	1.68
332	c	8	72.38	21.34	0.37	b	2.65	0.41	b	0.08	b	0.35	0.05	0.38	0.31	0.10	1.55
332	c	9	70.47	24.96	0.41	b	0.95	0.31	b	b	b	0.38	0.05	0.28	0.35	0.12	1.69
331	c	10	74.69	b	7.77	4.99	9.53	0.85	0.82	0.14	b	0.26	b	0.15	0.15	b	0.53
331	c	11	70.95	b	8.99	5.77	11.14	0.94	0.80	0.18	b	0.24	b	0.23	0.14	b	0.52
331	c	12	71.04	b	8.55	5.60	11.55	0.90	1.01	0.16	b	0.26	b	0.20	0.11	b	0.50
331	e	13	76.69	b	6.74	4.95	8.94	0.78	0.74	0.13	b	0.13	b	0.13	0.14	b	0.52
331	e	14	74.83	b	6.63	5.41	10.29	0.88	0.66	0.18	b	0.16	0.01	0.14	0.14	b	0.54
331	e	15	76.79	b	5.91	5.43	9.20	0.69	0.86	0.14	b	0.17	0.02	b	0.13	b	0.55
79	c	16	83.51	b	0.32	5.11	8.39	0.32	0.57	b	0.01	0.21	0.03	b	1.09	b	0.40
79	c	17	83.47	b	0.30	5.06	8.42	0.33	0.59	b	0.01	0.22	0.02	b	1.07	b	0.38
79	c	18	83.77	b	0.22	5.42	8.09	0.30	0.50	b	b	0.19	0.03	b	1.05	b	0.39
79	e	19	77.13	b	5.23	5.11	8.44	0.89	0.72	0.15	b	0.27	0.02	0.08	1.20	b	0.52
79	e	20	77.18	b	5.31	5.43	8.15	0.90	0.76	b	b	0.24	0.02	0.12	1.19	b	0.48
79	e	21	76.29	b	4.95	5.24	9.61	0.98	0.75	0.11	b	0.28	0.01	b	1.14	b	0.53
1	c	22	87.63	2.79	0.22	3.13	4.20	0.38	0.91	b	b	0.08	0.04	b	0.08	b	0.49
1	c	23	88.07	2.94	0.22	2.92	3.69	0.46	0.93	b	b	0.05	0.03	0.11	0.08	b	0.45
1	c	24	88.11	2.87	0.24	3.25	3.65	0.30	0.86	b	b	0.06	0.03	b	0.09	b	0.50
1	e	25	89.64	2.95	0.26	2.76	2.37	0.31	0.80	b	b	0.07	0.02	b	0.10	b	0.68
1	e	26	92.29	3.01	0.25	b	2.47	0.31	0.73	b	b	0.06	0.04	b	0.10	b	0.69
1	e	27	92.43	3.04	0.26	b	2.28	0.30	0.74	b	b	0.05	0.04	b	0.08	b	0.73
2	c	28	92.03	2.76	0.62	b	2.86	0.30	0.50	b	b	0.05	0.01	b	0.24	b	0.59

a. e = emperor side; c = cross patty side

b. Element below detection

Plate 1. Selected coins from the Belgrade Gate hoards (1:1 except #14)

1. Stavraton, Belgratkapı 2, no. 17, John V



2. Aspron, Belgratkapı 2, no. 863, John V



3. Tornese, Belgratkapı 1, no. 675, John V



4. Stavraton, Belgratkapı 2, no. 1251, Andronikos IV



5. Grosso, Belgratkapı 2, no. 1512, Bulgaria, Ivan Aleksandăr with Mihail Asen (1331–1355),



6. Grosso, Belgratkapı 2, no. 1591, Venice, Jacopo Tiepolo (1229–1249)



7. Soldino, Belgratkapı 2, no. 1698, Venice, Francesco Dandolo (1329–1339)



8. Gigliato, Belgratkapı 2, no. 1908, Provence, Robert d'Anjou (1309–1343)



9. Gigliato, Belgratkapı 2, no. 1911, Anatolian beyliks, in the name of Robert d'Anjou (1309–1343)



10. Denier tournois, Belgratkapı 2, no. 1948, Latin Greece, Achaia, Isabelle de Villehardouin (1297–1301)



11. Gigliato, Belgratkapı 2, no. 2140, Rhodes, Raymond Berenger (1365–1374)



12. Gigliato, Belgratkapı 2, no. 2141, Chios, Maona Company



14. Angulated shot of Belgratkapı 1, no. 332, with silvered surface



13. Akçe, Belgratkapı 2, Islamic cabinet, no. 1211/6, Osmanlis, Murad I (1360–1389)





Plate 2. Aspra of John V, Christ dies (2:1)







C025–C028



C029–C032



C033–C036



C037–C040



C041–C044



C045–C048

Plate 2. *(continued)*







C073–C076



C077–C080



C081–C084



C085–C088



C089–C092



C093–C096

Plate 2. (*continued*)

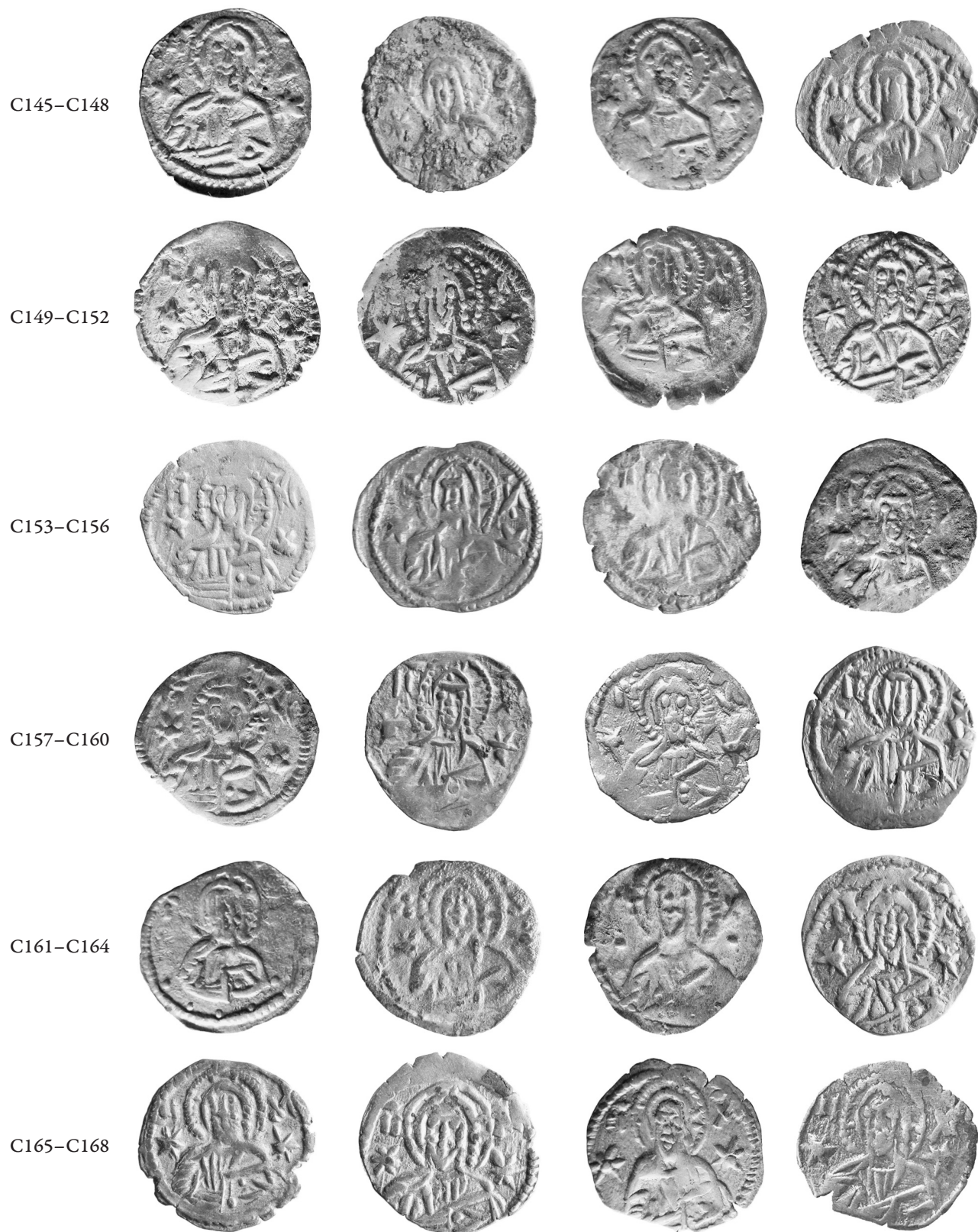








Plate 2. *(continued)*





C169–C172



C173–C176



C177–C180



C181



Plate 3. Aspra and tornesi of John V, emperor dies (2:1)







E025–E028



E029–E032



E033–E036



E037–E040



E041 (twice)–  
E043



E044–  
E045 (twice)



Plate 3. *(continued)*

E046 (twice)–  
E048



E049–  
E050 (twice)



E051–E054



E055–E058



E059–E062



E063–E066







E067–E070



E071–E074



E075–  
E076 (twice)



E077–E080



E081 (twice)–  
E082 (twice)



E083–E086



Plate 3. *(continued)*

E087 (twice)–  
E089



E090–E093



E094–E096  
(twice)



E097 (twice)–  
E098 (twice)



E099–  
E101 (twice)



E102, E103  
(twice), E104





Plate 4. Stavrata of John V and Andronikos IV, Christ dies (1:1)

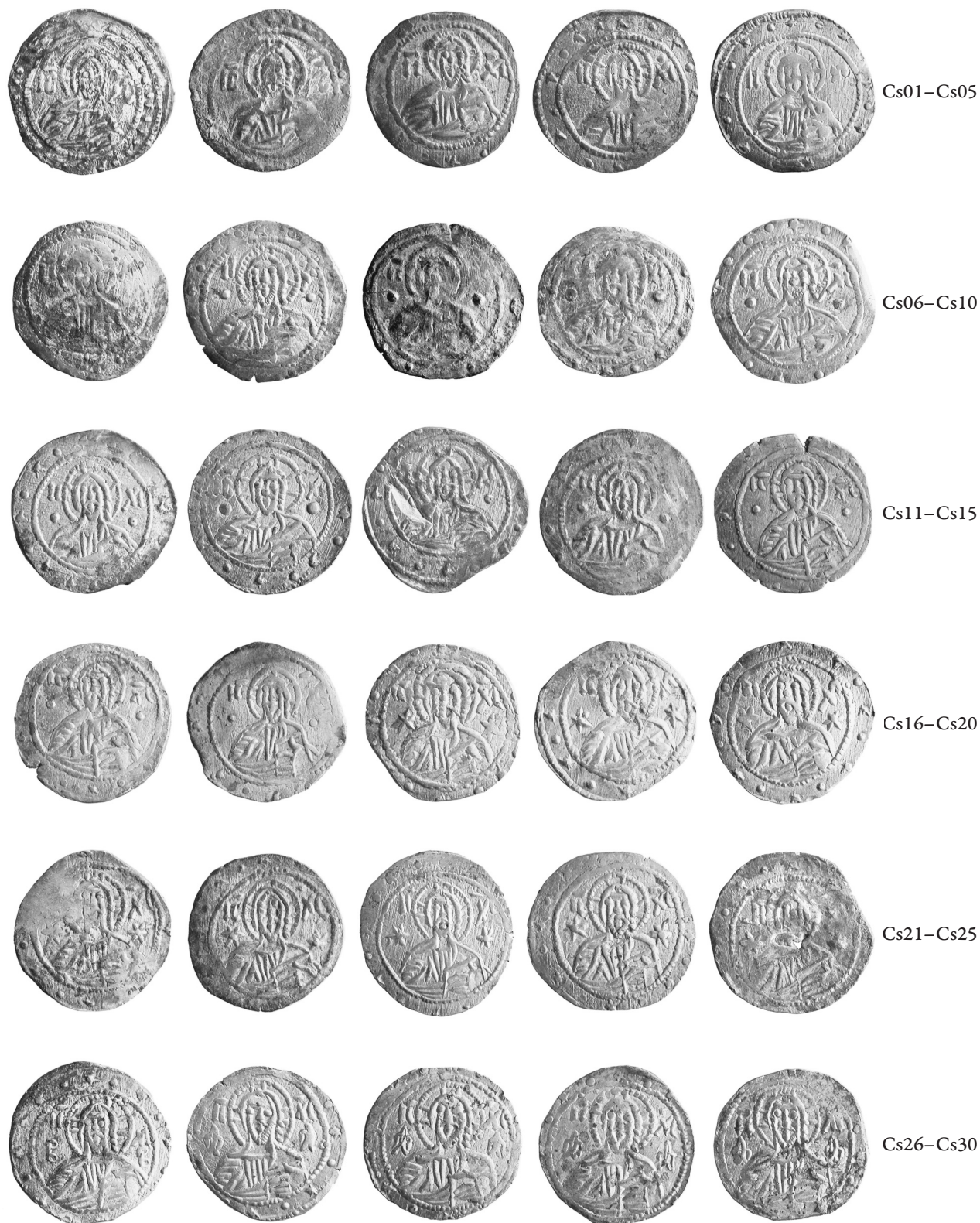


Plate 4. (*continued*)





Plate 5. Stavrata of John V and Andronikos IV, emperor dies (1:1)

